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THE METAL INDUSTRY

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ELECTRO-PLATERS REVIEW

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OF THE

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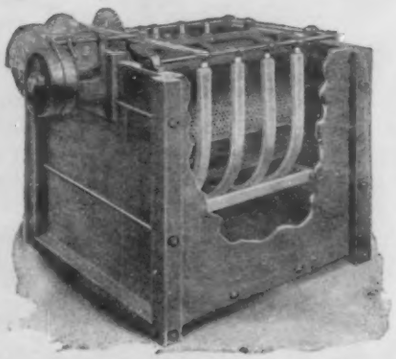

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THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD, COPPER AND BRASS, THE BRASS FOUNDER AND FINISHER AND
ELECTRO-PLATERS REVIEW

Vol. 18 NEW YORK, MAY, 1920 No. 5

Electric Melting in an Oil Furnace

A Method of Applying Electric Power to Existing Installations at a Great Saving in Cost

Written for The Metal Industry by WILLIAM J. REARDON, Foundry Editor

THE OIL SITUATION

The question of providing fuel oil requirements for the melting of brass and aluminum must be given consideration, and is a problem that confronts us for the immediate future.

The crude oil consumption for 1919 was greater than the production and so far this year there have not been, as far as I am able to determine, enough new wells driven, materially to increase the supply. with the increase in automobile production and use, the oil interests promise to do two things; crack the crude to a considerably greater extent than before, and raise the price of all oil products. With the cracking process being carried further than ever the fuel oil market will naturally be tighter than before, both for quantity and quality. There is scarcely any eastern crude available and any that is available is at a prohibitive price. We must then use western oil, which is an asphaltum base oil and has a very high cold test.

According to statistics compiled by the U. S. Bureau of Mines, the average monthl yrefinery output of fuel oil and gas oil in 1919 was 640,000,000 gallons; amount in store September 30, 1919, 862,000,000 gallons; amount in store December 30, 1919, 714,000,000 gallons. This indicates we are pulling on our surplus at the rate of 8 per cent a month, and at this rate will exhaust visible supplies within the next twelve months. A few weeks ago the Emergency Fleet Corporation requested bids from the refining industry on 1,000,000,000 gallons fuel oil. Total tenders received by the Emergency Fleet Corporation were 50,000,000 gallons. The Emergency Fleet Corporation has secured temporary relief by allocating Government tank steamers for use of producers and refiners to assist in moving crude from Mexico and finished product from Gulf and Seaboard refineries to take care of the Emergency Fleet Corporation for the immediate future.

The question is, how shall we melt our brass, without returning to crucible melting? For some time I have realized that something must be done to increase or keep up the production in the brass foundry. I gradually saw the shortage of fuel oil coming on us and I see now there is a possibility of oil shortage in New York City, which would cut off the gas supply. The Richmond Gas Company say that they are unable to renew their contract for gas oil, and without oil they will be unable to continue service; they attribute the scarcity of the fuel to the increased use by the Navy. The price of gas oil has increased from three to four cents a gallon to from seven to fifteen cents per gallon, so it remains for the foundry man to get busy and find a substitute. As I say, we cannot return to crucible melting, if for no other reason than the labor question, not to speak of the cost and quality, so in looking around, the substitute that suggests itself is the electric furnace.

APPLYING ELECTRICITY TO A SCHWARTZ FURNACE

The advantages of the electric furnace have been the foremost thought of the brass foundry, that is, a furnace that any ordinary man can run. The shortcomings of the different electric furnaces have been discussed from time to time, and it has been learned from experience that simplicity is one of the most essential conditions. I have designed with the aid of Mr. John Collins, a furnace equipment that can be attached to the ordinary Schwartz furnace. This idea dates back to December, 1913, when, with Mr. J. L. Jones, at Pittsburgh, we thought and

FIG. 1.—SIDE VIEW OF THE OIL FURNACE USING ELECTRICITY

worked on this design while experimenting with the Wild electric furnace, and this, in my opinion was the first work done with the idea of rotating. Mr. Jones and myself thought of the possibility of such a furnace and now with the aid of Mr. John Collins we have perfected a workable furnace that will be easy to rotate and at the same time keep the carbons concealed so that the oxygen will not come in contact with the hot carbon, by means of a water cooled and insulated copper tuyere into which the carbon is placed. This furnace we call the Preheated Electric Furnace. The idea is to heat it up with gas. A gas burner is placed in an opening in the charging door, a hose is placed in the gas and air lines to the burners which can be pulled out when the desired heat is attained. The electrodes are lowered to a point of contact by the lowering and lifting device, which is operated by a hand wheel on each side of the furnace. The furnace rocks, washing the lining with metal, keeping the electrode, charging door, and pouring spout above the level of the metal. The rotating is done by shift clutch, which when in place will rotate the furnace one-fourth of its circumference. A connecting rod is attached to a system of worm gears driven by a two horsepower motor to any desired rotating speed. To change or pour the furnace simply throw out the clutch and turn the hand wheel to any desired position. Roller bearings are placed on the trunnions to allow tilting the furnace easily.

A No. 60 Schwartz furnace was selected, as it melts a 2,000 pound charge conveniently and is most suitable for general foundry practice, but any size Schwartz furnace can be fitted up in the same manner. The lining of an electric furnace has been the one chief drawback

FIG. 2.—FRONT VIEW OF OIL FURNACE USING ELECTRICITY.

from the cost point of view. I have had many years of experience with the Schwartz furnace and I seldom replace the refractory material, in fact I can safely say once in ten years; but against the attacks of the electric arc I can only hope for the life of a refractory for a similar length of time. This furnace is of a 300 K. V. A. capacity, 220 volts, 60 cycle, single phase. The cost of lining is low and can be easily and quickly replaced.

The great improvement in operating electric furnaces in preference to oil open flame furnaces or crucible furnaces is that it will result in higher efficiency of the workmen because of the absence of noise and smoke and the presence of cooler atmosphere. For these reasons alone the electric furnace will eventually crowd the oil open flame and crucible furnace out of the foundry. The electric furnace should furnish what the open flame furnace would do if it had been handled properly. At the present time I have no figures to compare costs with, but I have hopes the cost will not be any greater than the crucible, with crucibles at twelve cents per number, coke $10.00 per ton, and the supply of oil fast becoming unobtainable. However, I have a copy of a test run made with the Schwartz open flame furnace using oil as fuel, the crucible furnace and an electric furnace.

The Lynite Laboratories of the Aluminum Castings Company made the following test under the technical supervision of Mr. T. D. Stay.

COMPARATIVE COST DATA ON THE ELECTRIC, SCHWARTZ AND COKE PIT FURNACES

Object

The object of this experiment is to determine the total melting costs of copper, tin, lead, zinc alloys in the Detroit Electric, Schwartz Oil, and Coke Pit Furnaces, including metal loss, fuel consumption, and labor costs.

Conclusions

From the data obtained the total cost of melting in the Coke Pit Furnace was twice that in the Schwartz Furnace, and the Electric Furnace 30 per cent higher than the Schwartz.

Melting Loss

Electric	0.94%
Schwartz	1.17%
Coke Pit	2.92%

The melting loss on the Schwartz furnace is 24 per cent higher than on the Electric, and the Coke Pit furnace is three times that of the Electric.

Fuel Cost

Electric	$6.10
Schwartz	3.72
Coke Pit	4.42

The fuel cost on the electric furnace is 39 per cent higher than on the Schwartz, and 28 per cent higher than the Coke Pit Furnace.

Labor Cost

Electric	$2.70
Schwartz	3.44
Coke Pit	5.43

The labor cost on the electric furnace is 21.8 per cent lower than the Schwartz and half that of the Pit Furnace.

Procedure

In carrying out this test the respective furnaces were run for a period of four days and the metal charged and poured was weighed, the power of fuel used was measured, and pouring temperatures recorded.

Apparatus

Schwartz Oil Furnace 42 in.
Detroit Electric Furnace 2,000 pound capacity.
Coke Pit Furnace, Round, natural draft.
Fairbanks platform scale for weighing fuel and metal.
Hoskins Pyrometer and thermo couple for taking temperatures.

Materials

New metal borings and gates for Lynux Nos 2, 4, 12, 37, 38, 40 and 95 were used.

Electric Furnace DATA.

Lynux No. 37.
Metal Charged .....25,377 lbs.
Metal poured .....25,136 lbs.
Metal Loss .....241 lbs.=0.94%
Power Consumption K. W. hours
Gross 380-30 (Holding Heats) = 350 Net K. W. Hours per ton.
Electrode Consumption, pounds per ton = 2.59.
Average Charging Time per heat (2,120 pounds) 11.5 minutes.
Net Furnace Hours per heat 110.0 minutes.
Average pouring time per heat 26.8 minutes.
Average pouring temperature 2280 deg. Fahr.

Schwartz Furnace

Lynux Nos. 1, 4, 27, 95.
Metal Charged .....15,266 lbs.
Metal poured .....15,071 lbs.
Metal Loss ..... 195 lbs. Gross..
0.25% non metallic 6150 lbs. bor. 15 lbs.
Net Loss .....180 lbs. = 1.71%
Fuel Oil Consumption—Oil 38 deg. be = .833 Sp. Gr.
Gross Oil Consumption—309.4 gal. = 2.02 gal per 100 lbs.
Net Oil Consumption (Holding heats deducted) 264.8 gal. or 1.73 gal. per 100 lbs.
Average charging time per heat (500 lbs.) 4.9 min.
Average furnace minutes (blow-delay) per heat 38.3 min.
Average pouring time per heat 8.9 min.
Average air pressure-oz. 15.4 min.
Average oil pressure-lbs. 23.8 min.
Average pouring temperature 2096 deg. Fahr.

Coke Pit Furnace

Lynux Nos. 2, 4, 12, 27, 38, 40, 95.
Metal charged .....14,355 lbs.
Metal poured .....13,935 lbs.
Metal Loss (ave).....420 lbs.=2.92%
Individual Losses
Lynux 2 .....2.0 %
Lynux 4 .....5.3 %
Lynux 12 .....2.5 %
Lynux 27 .....4.93%
Lynux 38 .....1.22%
Lynux 40 .....2.46%
Lynux 95 .....2.19%
Total Coke Consumption 6315 lbs. = 879 lbs. per ton.
Average minutes per heat (250 lbs.) 98.4.

Electric Furnace RESULTS.

Depreciation, etc., $29,000.00x0.17% = $4,930.00 per year.
Production 225 daysx9.5 heatsx1.06 tons = 2,265.75 tons.
Depreciation, etc., $4,930.00 divided by 2265.75 = $2.17 per ton.
Labor, including one foreman, two operators, one helper for two furnaces.
Hourly rates, foreman 70c, operator 60c, helper, 60c.
$20.40x300 days = $6120.00 yearly wages.
$6120 divided by 2,265.75 tons = $2.70 per ton.

Depreciation, interest, insurance taxes on $29,000.00 @ 17%	2.17
Allowing 225 working days and 9.5 hours per day on two furnaces	....
Power consumption, 380 K W hours per ton @ 1.6c per K W hr.	6.10
Electrode consumption, 4lbs. @ 22.46c	.90
Materials, including charcoal, brick, cement	.27
Lining costs $140.00 lasting 30 heats	1.00
Ladles, lining and heating	.20
Metal Loss, 0.94% or 18.8 lbs. @ 18c. per lb.	3.38
Labor, including foreman, furnace operator, helper	2.70
Total cost per ton	$16.72

Schwartz Furnace

Depreciation, etc., $1,040.00 initial cost, $1,090.00 installation, = $2,130.00 x 15 % = $319.50 per year.
2 tons x 275 days = 550 tons per year.
$319.50 divided by 550 = $0.58 per ton.

Repairs Including Lining

According to Mr. Reardon, a lining lasts eight years or more, which makes the relining cost nil. The operator spends two hours each week repairing lining.

2 hrs. at 60c. = $1.20
Materials ..... .50
Parts, gears ... .50
$2.20
$2.20 divided by 11 tons = $0.20 per ton.
Air cost including millwright.
30 HP motor for 12 furnaces.
30 HP = 22.5 K.W. x 10 hrs. = 225 K.W. hrs.
Millwright 4 hrs. @ 60c. = $2.40
225 K.W. hrs. x 1.6c. =.... 3.60
$6.00
$6.00 divided by 24 tons = $0.25 per ton.
Labor—foremen and 12 operators for 12 furnaces.
Foreman $10.00 per day..... $10.00
Operators $6.00 per day x 12.. 72.00
$82.00
$82.00 divided by 24 tons = $3.44 per ton.

Cost of Melting Per Ton

Depreciation, interest, insurance, taxes on $2,130.00 @ 15%. Allowing 275 working days and 8 — 500 lb. heats per day	$0.58
Gross Fuel (40.4 x .092)	3.72
Repairs, including lining	.20
Ladles—lining and heating	.20
Air including millwright	.25
Metal loss, 1.17% or 23.4 lbs. @ 18c	4.21
Labor, foreman and 12 operators for 12 furnaces	3.44
Total cost per ton	$12.60

Coke Pit Furnace

Depreciation, etc., on $1,000.00, four fires @ $125.00 = $500.00, Stack and flue $500.00) x 15% = $150.00 per year.
Annual production of four fires = 500 tons.
$150.00 divided by 500 equals $0.30 per ton.

Repairs Including Lining

Life of lining 3 months.
140 brick @ $0.21 = $29.40
Labor 6.00
$35.40
2 grates @ $14.00.... 28.00
Total $63.40
$63.40 divided by 125 tons = $0.50 per ton.
Crucible cost No. 90, 4,840 lbs. each.
No. 90 @ 13.6c. per No. = $12.24.
$12.24 divided by 2.42 tons = $5.06 per ton.

Metal Loss

Gross 2.92% = 58.4 lbs. @ 18c. = $10.51.
Ash 879 x 14% = 143 lbs. per ton metal melted.
143 x 7% = 10 lbs. metal recovered per ton metal melted.

10 lbs. @ 15c. = $1.50
Smelting cost.
143 lbs. @ .325 = 0.47

Net recovery..... $1.03 per ton metal melted.
Net metal loss $10.51 — $1.03 = $9.48.

Labor Cost

1 Foreman.....	$10.00	per day
8 furnace tenders..	50.00	" "
2 coke wheelers....	13.00	" "
2 pot pullers.....	9.50	" "
1 skimmer.....	4.50	" "
	$87.00	

Total Melting Cost Per Ton

Total Metal charged 14,355 lbs.
" " poured 13,935 "
" " loss 420 " = 2.92%
Total coke used 6,413 lbs. or 879 lbs. per ton metal.

brought the Pit Furnace costs up to such a high figure.

The Schwartz furnace was the most economical in all ways except the labor item where the Electric was cheapest. On the Pit Furnace in connection with the labor item, it must be noted that the labor turnover during the hot weather is high, due to the heat to which the workman is subject. On the Electric the items running high are the depreciation, power consumption, and lining cost. The Electric Furnace requires a higher degree of skilled labor than either of the other two for successful operation. The electrode consumption of 2.59 lbs. per ton is lower than that obtained in usual practice, four pounds is a better figure for continued operation, and this was used in the summary of the Electric Furnace costs.

I do not look for this furnace to be all that is desired for yellow brass or aluminum, however, I have in mind a furnace that looks as though it would be just the thing for yellow brass and aluminum, and one that almost any foundry would install at a reasonable cost. The furnace is designed as shown in Fig. 3. The electrodes are low-

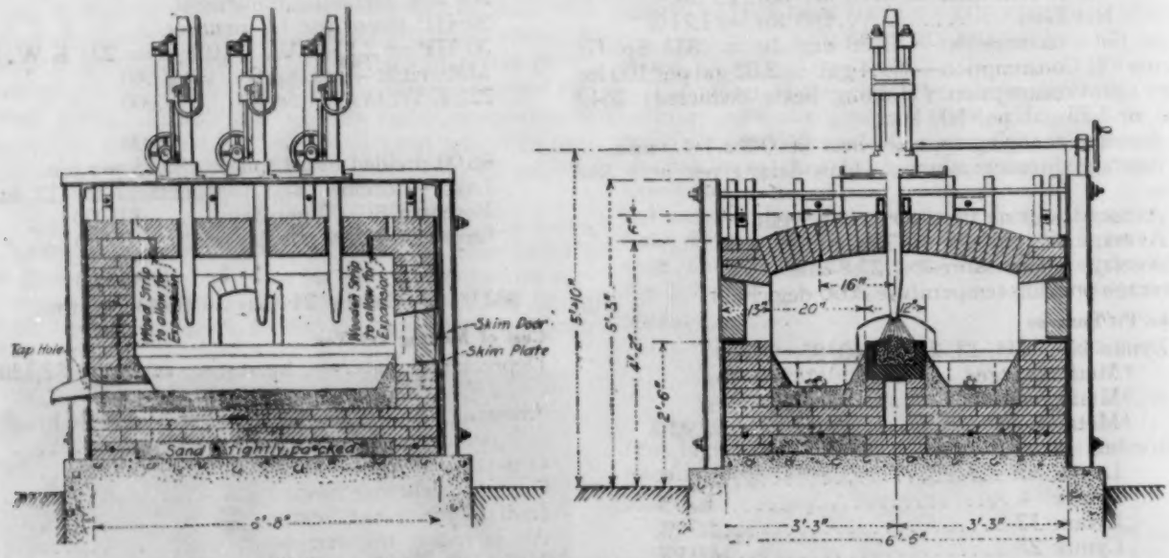


FIG. 3.—RENNERFELT ELECTRIC REVERBERATORY FURNACE.

Depreciation, interest, insurance, taxes on $1,000.00 at 15% allowing 500 tons annual production on four fires	$0.30
Fuel 0.439 @ $10.06 allowing 10% loss in fines and $1.00 per ton unloading charge	4.42
Repairs, including lining, brick @ 21c. each. Each lining 3 months	.50
Crucible, No. 90, 4,840 lbs. metal each, 13.6c. per No	5.06
Metal loss, 2.92% or 58.4 lbs. @ 18c. per lb. Recovered in ashes 3.3 lbs. metal @ 15c. = 49c. per ton metal melted	9.48
Labor, including 1 foreman, 8 furnace tenders, 2 coke wheelers, 2 pot pullers, 1 skimmer for 32 fires	5.43
Total cost per ton	$25.19

DISCUSSION AND GENERAL CONCLUSIONS.

The results obtained proved definitely that the Schwartz was the cheapest of the three furnaces to operate. The results from each furnace compared favorably with that obtained in the general practice of its respective type. The metal loss on the Pit Furnace was low for general Pit furnace practice. The cost of fuel, labor, metal loss, and crucibles were the items which

ered into a carborundum trough packed with granulated carbon and the heat is radiated evenly over the whole bath on both sides of the trough. I have been told such a furnace will shortly be put on the market; if so it looks good to me for melting aluminum. The common practice is to melt aluminum in iron pots, and although this may be the right way, the method is both costly and wasteful, to say nothing of the effect it has on the metal. At a later date I will have more to say on this practice.

The smothered arc should be the ideal method of melting aluminum, with no air, and heat from reflection. Among the advantages I look for under this process are economy of operation, better control of melting and heat, cleaner aluminum, by reducing the oxidizing effect of coming into contact with the air, making less dross, the remelting of returned gates and scrap without injuring the metal, and the clearing up of many of the peculiar and mysterious troubles of aluminum castings business.

Unfortunately it seems to be the common impression that various castings of aluminum are peculiar each to itself. As a matter of fact all general alloys of aluminum obey the same laws when the melting is done properly and a great light will dawn upon the aluminum foundrymen, i. e., that there are but few really basic troubles in the casting of aluminum.

Melting in a Detroit Electric Furnace

This data was sent at our request for comparison with the figures of the preceding article by W. J. Reardon. They represent, taken together, a complete summary of the work that this type of furnace will do. For the following information we are indebted to H. M. St. John, Service Manager, The Detroit Electric Furnace Company, Detroit, Mich.—Ed.

Michigan Lubricator Company

DETROIT, MICH., AUGUST 29-SEPTEMBER 8.

Alloy melted	Cu.	Sn.	Pb.	Zn.
	73	4	5	18

Amt. metal melted in 7 working days	74,000 lbs.
No. of heats	37
Av. heat	2,000 lbs.
Total working time	66.67 hrs.
Heats per 9-hr. day	5
Av. kw. hrs. per ton	299
Av. electrode consumption per ton	3.2 lbs.
Av. melting time per ton	1 hr. 13 min.
Gross shrinkage	2.5%
Non-metallic in charge	1.6%
Net metal loss	0.9%
Chips (some clean, some dirty)	55%
Average charge, gates and scrap	39%
Pb. and Cu	6%

Detroit Copper & Brass Rolling Mills

SEPTEMBER 2-8, 1919.

Alloy melted	Cu.	Zn.
	60	40

Metal melted in 5½ working days	68,000 lbs.
No. of heats	34
Av. heat	2,000 lbs.
Heats per 9-hr. day	6
Av. kw. hrs. per ton	262
Av. melting time per ton	57 min.
Net metal loss	0.90%
Nature of charge, scrap	50%
New metal	50%

General Aluminum & Brass Mfg. Company

OCTOBER 27-NOVEMBER 1, 1919.

Alloy melted	Cu.	Sn.	Pb.	Zn.
	85	5	5	5

Amt. metal melted in 5½ working days		68,401 lbs.
No. of heats		35
Av. heat		1,954 lbs.
Total working time		59.67 hrs.
Heats per 9-hr. day		6
Av. kw. hrs. per ton		280
Av. electrode consumption per ton		3.47 lbs.
Av. melting time per ton		1 hr. 1 min.
Gross metal loss		0.44%
Av. pouring temperature		2,084° F.
Average Charge	Copper ingot	29.1%
	Brass ingot	4.4%
	Foundry scrap	38.2%
	Borings	24.0%
	New lead	3.4%
	New zinc	0.1%
	New tin	0.9%

Cleveland Brass & Copper Rolling Mills

CLEVELAND, Ohio, November 5-13, 1919.

OPERATING ONE 2,000-LB. FURNACE.

Alloy melted, copper		60%
Lead		2.5%
Zinc		37.5%
Nature of charge	Heavy scrap	1,000 lbs.
	Light scrap	900 lbs.
	Total	1,900 lbs.
Tonnage melted in 5½ working days		66,500 lbs.
Working day		8 hrs.
Heats per day		6
Electrode consumption per ton		2.4 lbs.
Av. melting time per heat		43½ min.
Av. kw. hrs. per ton		206
Gross shrinkage		1%

Chase Metal Works

OPERATING FOUR 2,000-LB. FURNACES.

Alloy melted	Cu.	Zn.
	60%	40%

Tonnage melted		500 tons
Av. melting time per ton		51½ min.
Av. kw. hrs. per ton		224
Av. net metal loss		1.02%
Nature of charge	New copper	600 lbs.
	New zinc	400 lbs.
	Mixed heavy scrap and briquetted borings	1,000 lbs.

Detroit Electric Furnace in Large Brass Foundry.

Detailed Operating Data.

Composition of alloy	Cu.	Sn.	Pb.	Zn.
	85	5	5	5

Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
		....	6:00	Preheat		....	125
10-27	1	2016	6:35	7:47	1:12	1974	340
	2	2016	8:32	9:38	1:06	2009	310
	3	2016	10:18	11:21	1:03	2032	295
	4	2016	12:00	1:00	1:00	1989	280
	5	2016	1:40	2:35	:55	2007	275
	6	1613	3:17	1:00	:43	1613	215
		11693			5:59	11624	1840

Metal melted	5.85 tons
Melting time per ton	1 hr. 1 min.
Kw. hrs. per ton	314
Gross shrinkage	0.59%

Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
10 28	1	2016	5:45	7:02	1:17	2002	345
	2	2016	8:00	9:02	1:02	2010	305
	3	2016	10:08	11:06	:58	2011	280
	4	2016	11:40	1:07	1:27	2005	320
	5	2016	1:55	2:45	:50	2003	275
	6	1613	3:30	4:10	:40	1620	205
	*7	938	4.33	4:53	:20	926	95
		12631			6:34	12577	1825

Metal melted	6.32 tons
Melting time per ton	1 hr. 2 min.
Kw. hrs. per ton	289
Gross shrinkage	0.43%

This charge all borings.

Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
10-29	1	2016	5:39	7:00	1:21	2012	335
	2	2019	7:55	8:55	1:00	1975	287
	3	2019	9:35	10:30	:55	2024	260
	4	2007	11:00	12:00	1:00	2000	283
	5	2006	12:25	1:19	:54	2018	259
	6	2010	1:45	2:34	:49	2002	249
	7	2008	2:59	3:55	:56	2017	255
		14085			6:55	14048	1928

Metal melted	7.04 tons
Melting time per ton	59 min.
Kw. hrs. per ton	274
Gross shrinkage	0.26%

Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
10-30	1	2004	5:48	7:02	1:14	1962	325
	2	2004	8:00	9:00	1:00	2007	275
	3	2003	9:40	10:35	:55	1994	258
	4	2003	11:10	12:03	:53	1997	245
	5	2003	12:40	1:30	:50	1994	250
	6	2003	2:14	3:30	1:16	2022	260
		12020			6:28	11976	1613

Metal melted	6.01 tons
Melting time per ton	1 hr. 5 min.
Kw. hrs. per ton	268
Gross shrinkage	0.37%

Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
10-31	1	2003	5:47	7:13	1:26	1989	322
	2	1908	7:55	8:50	:55	1903	260
	3	2008	9:30	10:24	:54	1994	270
	4	2008	11:03	12:00	:57	1970	260
	5	2008	12:40	1:33	:53	1991	350
	6	2016	2:20	3:27	1:07	2022	260
		11951			6:12	11869	1622

Metal melted ..... 5.98 tons
Melting time per ton ..... 1 hr. 2 min.
Gross shrinkage 0.69%
Kw. hrs. per ton 271

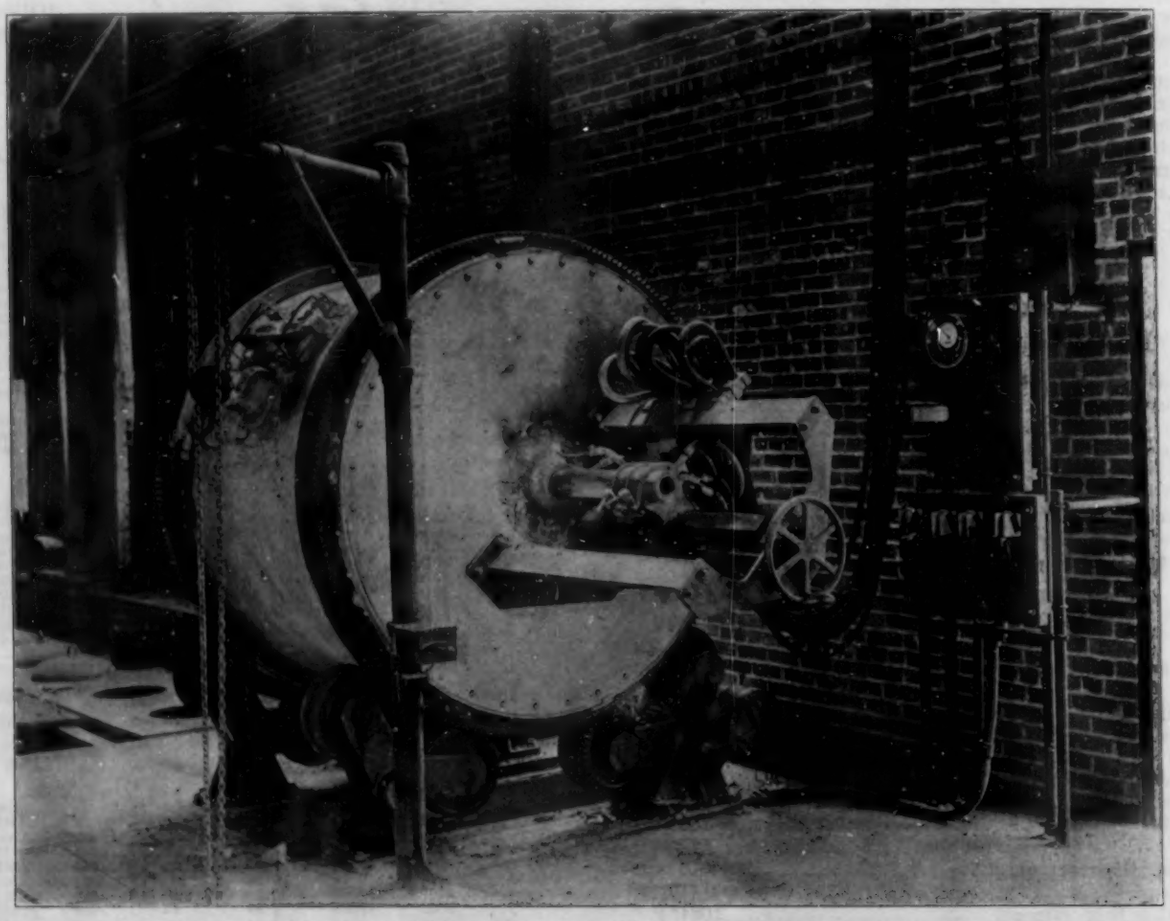
Date.	Heat No.	Metal Charged.	Time Arc On.	Time Arc Off.	Melting Time.	Amt. Metal Poured.	Kw. Hrs. Used.
11-1	1	2008	5:47	7:12	1:25	2001	328
	2	2008	8:00	9:30	1:30	2000	310
	3	2008	10:12	11:10	:58	2006	263
		6024			3:53	6007	901

Metal melted ..... 3.01 tons
Melting time per heat ..... 1 hr. 17 min.
Kw. hrs. per ton 299
Gross shrinkage 0.28%

SUMMARY.

Metal melted in 5½ working days ..... 68,401 lbs.
No. of heats 35
Heats per 9-hr. day 6
Av. kw. hrs. per ton 280
Av. electrode consumption per ton ..... 3.47 lbs.
Av. melting time per ton ..... 1 hr. 1 min.
Gross metal loss 0.44%
Av. pouring temperature ..... 2,084° F.

Average charge		
	Copper ingot	29.0%
	Brass ingot	4.4%
	Foundry scrap	38.2%
	Borings	24.0%
	New lead	3.4%
	New zinc	0.1%
	New tin	0.9%
		100.0%



DETROIT ROCKING ELECTRIC FURNACE.

Clay for Crucibles

American brass manufacturers until the war held that graphite from Ceylon and German Klingenberg clay were necessary in the melting of brass melting crucibles. Consequently most of the graphite and bond clay used in the manufacture of crucibles were imported.

When the war came and the manufacturers were deprived of these imports, the Bureau of Mines, Department of the Interior, began experimenting to see if the so-called inferior American clays would answer the purpose. Over 450 full sized crucibles have been made at the Ceramic station of the Bureau of Mines at Columbus, Ohio, and tested in brass making. Two different tests made on brass melting crucibles in two different foundries indicate that the domestic flake graphite gives a crucible of greater service than those made from Ceylon graphite. The Bureau of Mines states that these two tests are not sufficient to be conclusive and more extensive tests are now in progress to determine this point.

Of the bond clay tests, the bureau states that the work has been sufficiently thorough to indicate that there are two American clays superior to the German Klingenberg clay for bonding brass melting crucibles.

Insofar as bond clays for graphite crucibles are concerned, the Bureau of Mines says the United States is now nationally independent, the hold which the German Klingenberg clay held on the crucible trade having been finally broken.

The Ajax-Northrup Electric Furnace

A Complete Description of the Most Recent Development. Melting Metals With High Frequency Induction

By DUDLEY WILLCOX

HISTORY.

The development of this furnace dates from 1916, when Dr. Edwin F. Northrup of Princeton University started the experiments which have led to the commercialized product described herein. The work was financed by the Ajax Metal Company of Philadelphia, and the mechanical parts were made by the Pyrolectric Instrument Company of Trenton, N. J. During the first two years the experiments were carried on at the Palmer Physical Laboratory, Princeton University. From that time the laboratory of the Pyrolectric Instrument Company was used. The Ajax Electrothermic Corporation, 636 E. State St., Trenton, N. J., was organized in 1920, to take over the manufacture and sale of the high frequency induction apparatus and furnaces using a part of the former personal of the Pyrolectric Instrument Company. The officers are: G. H. Clamer, President; E. F. Northrup, Vice-President and Technical Adviser; Dudley Willcox, Secretary and Sales Manager; H. F. Porter, Treasurer and Works Manager.

A NEW PRINCIPLE.

The Ajax-Northrup High Frequency Induction Furnace for the first time makes possible the heating of a cylinder or sphere or any other solid shape of conducting material without the use of an arc or any other electrical connection to the mass to be heated. The mass may be surrounded completely with refractory material so that the heat losses are reduced to a minimum. The refractory around the mass is in turn surrounded with a single layer solenoid, carrying an electric current of high frequency. The coil remains cold while the mass attains a high temperature due to eddy currents induced in it. Unlike other induction furnaces, there is no necessity for an interlinkage of a magnetic circuit with the electric circuit. With furnaces of proper proportions temperatures have been attained sufficient to melt molybdenum, whose melting point is said to be 2550 degrees C.

THE HIGH FREQUENCY CONVERTER SYSTEM,

General Features

For the transformation of ordinary commercial currents to the required voltage and frequency, there has been developed a highly efficient combination for any power below 60 K.W. This is pictured in Figure 1; 110,220, or 440 volt, 60 cycle supply lines are attached behind the switchboard and high frequency current, for the furnace is drawn from wires shown extending from the base of the cage. By special arrangement, furnaces can be made up to operate on 60 cycle lines of any voltage, single, two or three phase. They have also been made to utilize 550 cycle current and 50 cycle current.

Ease of Control

There are but three handles to be manipulated. In starting the furnace when cold, the hand wheel shown in Fig. 1 at the left of the switch is turned to its extreme position in a clockwise direction. The switch is then closed, which starts the furnace at minimum power, about 10 per cent of maximum. The dropper at the upper right-hand corner of the switchboard is opened and left open as long as the furnace is operating. The power is now increased as rapidly as desired by turning the hand wheel in a counter clockwise direction. The power input can be increased or reduced at will by infinitesimal steps from about 10 per cent to rated maximum, or slightly more (about 12 per cent) for short runs.

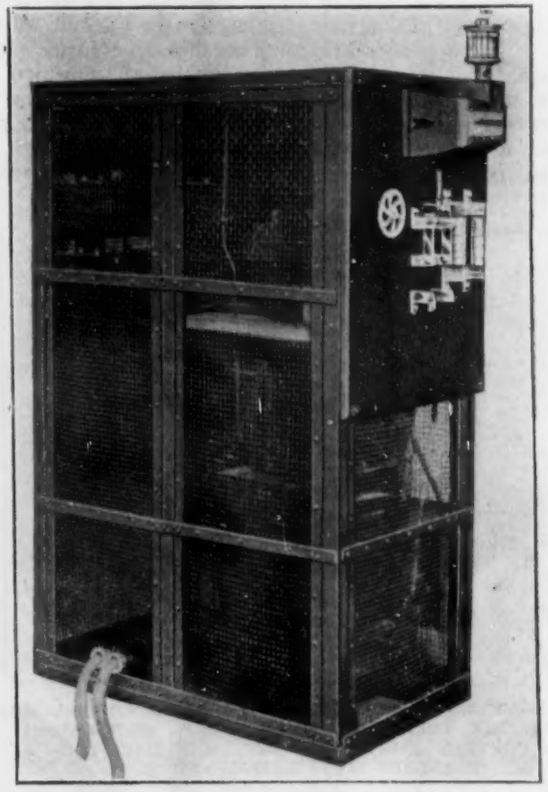


FIG. 1.—OSCILLATORY CURRENT CONVERTER SYSTEM OF 18 K.W. CAPACITY, PRIMARY VOLTAGE 220.

Dependability

The high frequency generator system has no moving parts and is highly dependable. It will operate day in and day out without trouble. A common laborer can learn very quickly to operate the system to good advantage.

Replacement and Wear

The only attention necessary is an occasional inspection of the mercury "Discharge Gap." About every 500 hours of full power operation two small graphite tips must be unscrewed from their position and replaced with new ones. The cost of these tips is nominal. The dropper should be filled daily with denatured alcohol. The amount of alcohol used is very small, about 1 pint being sufficient for 300 K.W.H.

Safety

The cage containing the high frequency converter system is grounded. The high frequency current cables to the furnace are heavily insulated and are led into a grounded enclosure containing the furnace. The furnace is not dangerous. It has been in use for about four years in all sorts of experimental combinations and no has ever received even a severe shock.

Sizes Available

The high frequency converter system has been standardized in three sizes, 2 K.W., 20 K.W. and 60 K.W. The two smaller sizes are designed for 110 or 220 volt single phase, 60 cycle current and the 60 K.W. size for three phase, 110, 220 or 660 volt 60 cycle current. The system can be adapted to other voltages and frequencies at special prices which will be quoted upon request. The system is not limited to units of 60 K.W., but up to date has only been commercialized in units up to this size.

A Standard Form

A much used form of single phase furnace is shown in Fig. 2 and in diagrammatic section in Fig. 3. When two or three phases are used on the same furnace the inductor coil is separated along its length into two or three equal sections and the voltage from one phase is impressed upon each section. The coil is of copper tubing and is cooled with water which flows through it. When polyphase currents are employed independent water terminals are supplied for each phase.

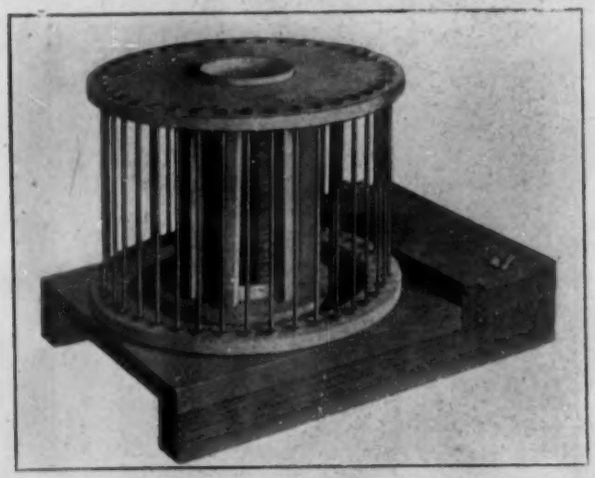


FIG. 2.—MODEL D-1 FURNACE PROPER DESIGNED TO ABSORB ALL THE ENERGY FROM AN 18 K.W. OSCILLATORY CURRENT CONVERTER SET. MAXIMUM TEMPERATURE ATTAINABLE 2600° C.

Little Wastage of Heat

The material to be heated absorbs practically all the heat generated. There are no electrodes to carry away heat as in the ordinary electrode steel furnace. There are no terminals to carry away heat as in the ordinary resistance furnace. The furnace can be made closely to approach the spherical form, for that minimum radiating surface is exposed to the refractory lining.

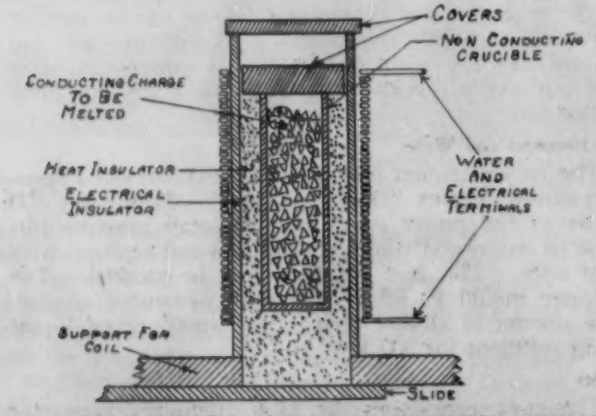


FIG. 3.—DIAGRAMMATIC SECTION OF INDUCTION FURNACE, SHOWING CRUCIBLE CHARGED WITH CONDUCTING PARTICLES READY TO BE MELTED.

Cool Outside

The furnace is between the temperature of ordinary tap water and 100° C. on the outside, even when temperatures in excess of 2500° C. are reached inside. This feature makes it a pleasure to work around it, even in the summer time, and especially when one is used to the heat encountered in working about an ordinary gas or oil furnace.

Quiet

The system is practically noiseless when running at any power, there being only a slight hum which is an actual advantage, as it indicates that the power is turned on.

Speed

Everyone who sees the furnace is impressed with its rapidity of heating. This feature is especially valuable in research work, in which much time heretofore has been lost in waiting for the ordinary electric furnace to come up to the required temperature. A filled crucible of Acheson graphite 2½" I.D. by 7" long can be heated with 18 K.W. to a temperature over 2500° C. in less than 20 minutes.

Easy to Reline

The inductor coil of copper tubing has immediately within it a loose fitting cylindrical tube which is an electrical insulator. Into this tube may be poured a refractory material in powdered, granular or other form up to a point flush with the bottom of the inductor coil. The kind of refractory used depends upon the temperature which it is desired to attain, and the nature of the material to be heated. A crucible, either conducting or non-conducting, is now placed with its bottom on the loose refractory and its sides located centrally in the tube. If a non-conducting material is to be heated a conducting crucible is used. If a conducting material is to be heated a non-conducting crucible may be used. More of the refractory material is then poured in between the tube and the crucible until the space is filled. The furnace is now charged with the material to be heated. See Fig. 3. When the heat is completed the crucible may be withdrawn from the furnace with suitable tongs and the refractory material may be dropped

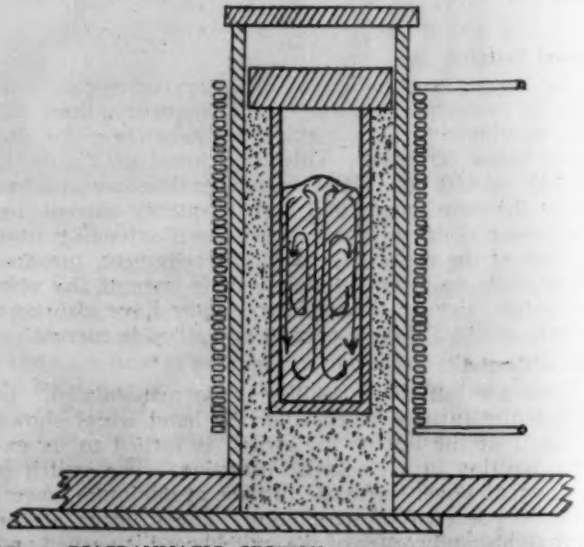


FIG. 4.—DIAGRAMMATIC SECTION OF INDUCTION FURNACE SHOWING CHARGE MELTED AND STIRRING ACTION DUE TO ELECTRO-MAGNETIC FORCE. NOTE RISE IN MIDDLE, AT CENTER OF CRUCIBLE.

at once through a hole in the base of the furnace. The inductor coil remains cool throughout the melt and the furnace may be at once repacked with different material and started again.

Stirring Action

Attention is called to Fig. 4 showing the electromagnetic stirring action which makes it possible thoroughly to mix the constituent parts of a melt of an alloy. The effect may be increased by constricting the coil and the crucible at the bottom so that more heat will be produced at the bottom than at the top of the mix, thus causing mechanical stirring by the action of the hot metal rising to the top.

Flexibility

The furnace may be used for small melts as well as for large. If a conducting crucible is used, either of graphite, nickel, iron, platinum or other material, the crucible forms the heating element. Even when a large part of the wall of a crucible is worn away, a very uniform heat is maintained throughout the walls owing to the unique manner in which the electrical energy is applied. A small button of material can be melted in such a crucible as well as a mass which fills it.

Renewal of Parts

As the crucible, refractory, electrical insulating tube, coil and protection cage are all loose parts arranged concentrically, the furnace is very easy to take apart. The current cables are attached by bolts and wing nuts to slotted terminals which are readily accessible. The water terminals are ordinary hose nipples adjacent to the electrical terminals. All parts may be obtained on short notice from the factory and may easily be placed in position by the user.

Melts in Vacuum

For melting in vacuum a long quartz tube is used, as shown in Fig. 5. The bottom of the tube is closed, the bottom and side walls being molded in one piece. The top is sealed by luting on an aluminum ring and sealing above this a water-cooled plate into which the vacuum pipe is inserted. As there are no electrical connections to run through the walls of the vacuum chamber, a high vacuum is readily maintained. The pump for producing the vacuum is not included with the furnace.

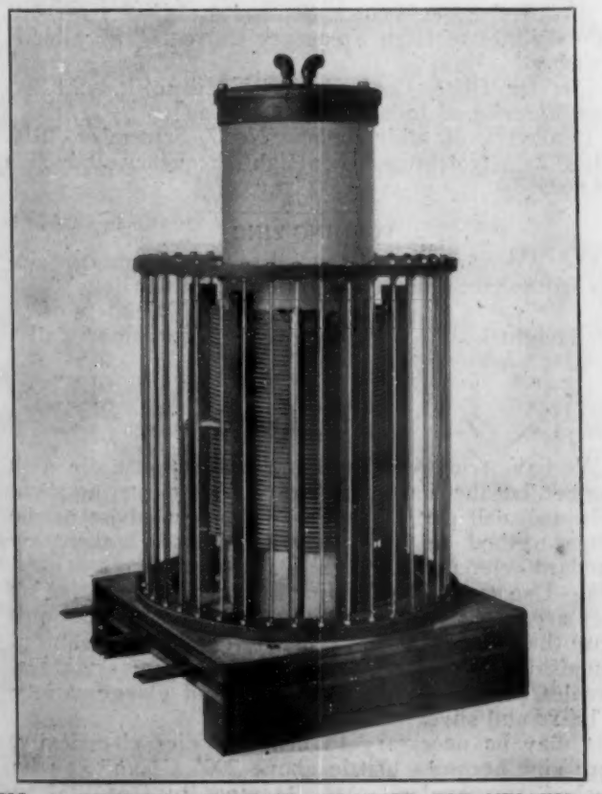
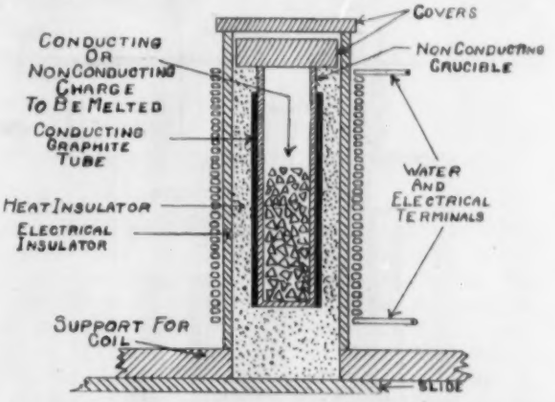


FIG. 5.—INDUCTION FURNACE ARRANGED FOR MELTING IN VACUUM OR IN ANY GAS.

INDUSTRIAL APPLICATIONS.

Melting, Gold, Silver, Brass and Bronze

In Fig. 6 is shown a cross-sectional view with dimensions given for use with a supply of 18 K.W. This furnace develops its heat in the graphite or carbon lining which fits loosely on the inside of a non-conducting refractory crucible. The design was made for a gold and silver melting furnace and the precious metal is ladled or dipped out. It will hold a charge of about 2856 troy ounces of gold and is estimated to melt about 180 troy ounces per kilowatt hour. Designs are completed for a tilting pouring furnace of similar size and for similar use. It is also admirably adapted for melting small quantities of brass and bronze alloys. The temperature may be forced up till nickel melts.



CROSS-SECTIONAL VIEW OF FURNACE FOR GOLD AND SILVER MELTING WITH 18 K.W. OUTFIT. THIS AMOUNT OF POWER WILL PRODUCE THE NICKEL POINT (1452° C.), WITHOUT DIFFICULTY, IN THIS SIZE FURNACE. THE CRUCIBLE WILL HOLD ABOUT 95 KILOGRAMS OF GOLD.

Melting Platinum

For melting platinum and other metals of this group a small lime, zirconia or magnesia crucible is embedded in a pocket of refractory sand or powder, and the current is induced directly in the metal to be melted within the crucible, thus assuring melts strictly carbon free and uncontaminated.

Heat Treatment Contemplated

It is planned for the heat-treating of tool steel to construct inductor coils which are shaped to conform somewhat to the piece to be treated. In this way it is possible to temper lathe and planer tools and various shaped dies and castings. The heat is induced directly in the metal to be treated and a very uniform heat is soon reached throughout the mass.

The temperature can be raised as rapidly as desired **and held as long as necessary at any desired temperature. As no part of the furnace is any hotter than the piece to be treated, the rise in temperature can be checked instantaneously, a feat impossible with the ordinary radiation type of furnace.**

Annealing

For rods, bars, tubes or other shapes of brass, gold, silver, iron, steel or, in fact, any metal to be made

malleable this furnace is the latest and best means of annealing. The tube or rod may be heated very rapidly as it is passed through a coil. The process has not been commercialized at this writing but it offers one of the most attractive fields of usefulness for this furnace.

Melting Glass and Heat Treating Porcelain

For this use the furnace is made in the general form shown in Fig. 7. The material to be melted or heated is enclosed in a quartz tube closed at the bottom. This prevents all access of the carbonaceous atmosphere where this is objectionable. The temperature may be raised until the quartz casing softens. If the desired temperature lies under 1425° C., a nickel cylinder, used

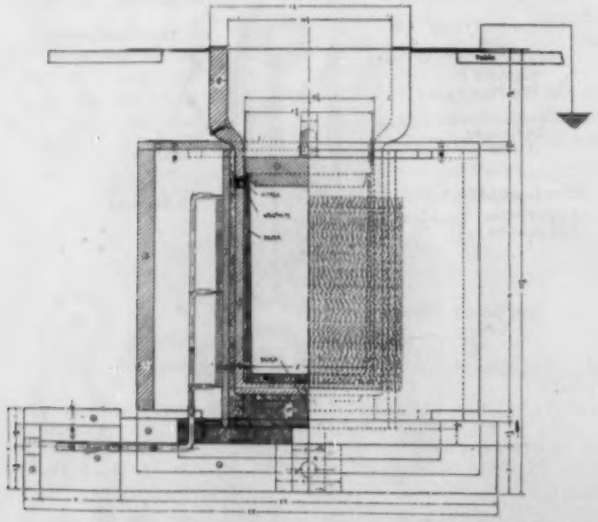


FIG. 7.—DIAGRAMMATIC SECTION OF INDUCTION FURNACE SHOWING METHOD OF MELTING BY RADIATION AND CONDUCTION FROM A CONDUCTING TUBE.

as a resistor, may be substituted for the inner conducting graphite cylinder, and then no carbon will be present and the quartz casing may be omitted.

Melting Oxides

Many refractory oxides, including chromium oxide, have been melted in our laboratory. To do this a cylindrical crucible is moulded of fine carborundum and is surrounded by a thin walled graphite cylinder. Pure zirconia is used as a heat insulator and as a wash on the inside of the carborundum crucible. The temperature obtained readily melts the oxides which do not exceed chromium oxide in refractivity. Some small reduction of the oxide being melted takes place, but the heating is very rapid and soon masses of fused unreduced oxide are obtainable.

GENERAL REMARKS.

Although it would seem obvious, it is, nevertheless, worthy of statement that when a fixed amount of power only is available, as utilized in the form of high frequency power, the smaller the volume to be heated the higher is the temperature, within limits, that can be attained.

We cite a particular case which will give an idea of the relation of power to final temperature attained. With 12 kilowatts available a chamber lined with graphite, 2¼" inside diameter by 7½" long, reached a temperature of 2500° C. in 15 minutes, while the same power heated a chamber 7¼" inside diameter by 36" long to a temperature of 925° C. in one hour.

At the temperatures given, the respective furnaces reached equilibrium, or, in other words, with a constant input of 12 kilowatts no higher temperature is possible because the radiation and conduction outward is equivalent to 12 kilowatts loss.

This means that the maximum temperature to be reached, in melting or heat treating a mass of material, has a very great bearing on the total amount of material which should be heated at one time with a given amount of power. The aim, of course, in melting, is to make as large as possible the figure representing pounds per kilowatt hour over a considerable period of time. Crucibles for holding the charge should be made smaller for high melting metals than for low melting metals.

Bibliography

All material written to date on the Ajax Northrup Furnace is included in the following references:

Transactions of the Faraday Society, Vol. XIII, 1918. "Production of High Temperature and Its Measurement," by E. F. Northrup.

Chemical and Metallurgical Engineering, August 1, 1918. Pages 155, 156. "Northrup-Ajax High Frequency Induction Furnace."

Transactions of American Electrochemical Society, covering April 3-5, 1919, meeting, held in New York, "Principles of Inductive Heating with High Frequency Currents," by E. F. Northrup. 88-page article on the mathematical and physical theory soon to appear in the yearly transactions.

Pyrolectric Monthly Bulletin No. 3, April, 1919. "Production of Carbon Free Alloys of High Melting Point," by E. F. Northrup. Out of Print.

Electrical Record, April, 1919, pages 245-247. "High Frequency Induction Furnace."

Chemical and Metallurgical Engineering, April 15, 1919. Pages 371-382. "Principles of Inductive Heating with High Frequency Currents."

The Iron Age, May 15, 1919. Pages 1294-1295. "High Frequency Unit for Making Carbon-Free Alloy of High Melting Point."

Chemical and Metallurgical Engineering, Sept. 1, 1919. Pages 258-259. "Electrical Productions of Carbon-Free Alloys."

Electrical Experimenter, September, 1919. Page 410. "Possibilities of High Frequency Currents," by John F. Pritchard.

Circular, Henry Coe and Clerici, Milano, Italy. "Fornace Elettrica ad Induzione." (in Italian).

Pyrolectric Monthly Bulletin No. 7, September, 1919. Page 2. "Northrup-Ajax High Frequency Induction Furnace."

FORMING ZINC

Q.—We want to make small seamless zinc containers from sheet zinc, of the following dimensions:

Height	Outside diam.	Thickness of container wall
2¼"	1¼"	.015"
2⅛"	¾"	.0125"
1⅞"	15/16"	.0125"
1⅞"	⅝"	.0125"

We have tried pushing the zinc through a die with plunger, but the zinc would shear off after entering about ¼" into small part of the die. Can you advise us the proper method and details of this process? Is there any standard reference on work of this nature?

A.—Use a double drawing press on sheet zinc as they are particularly adapted for articles that require more than one drawing to reduce them to the required dimensions. This style of press is used on cartridges, ferrules, pencil tubes, burner tubes, and a large variety of brass and silverware.

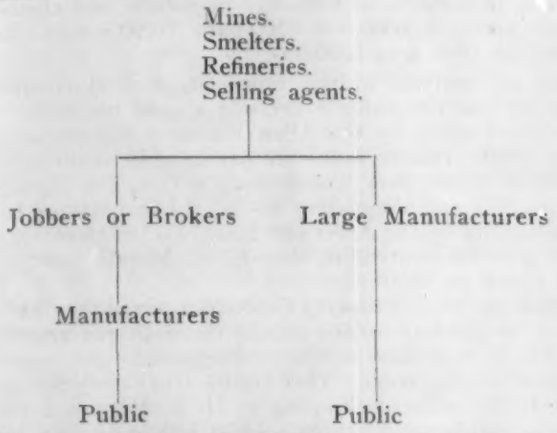
It may be necessary to heat the dies electrically. Pure zinc becomes brittle above 200° C., and can be crushed to powder. At a temperature of 125° to 150° C., it becomes malleable, can be rolled and retains its malleability in the cold when so treated.—P. W. B.

The Distribution of Copper

Article 2 of a Series on the Metal Business. The Hands Through Which Copper Passes to Reach the User

Written for The Metal Industry by ADOLPH BREGMAN, Managing Editor

The progress of copper from its crudest form to its final users is illustrated best by the following chart, which shows the various hands through which it passes:



In the article on the Production of Copper,* the description was carried through the process of refining to the marketable form. By "marketable form," however, it is not meant that the metal must be in one shape. As a matter of fact copper as metal is sold in any of the following shapes and grades:

Lake.—Copper from the native copper mines of the Lake Superior District. The Standard Range of conductivity is 99.5%.

Electrolytic.—Copper refined by the electrolytic process and running 99.93% upwards for cathodes. Conductivity to 103%.

Casting.—Copper analyzing 98.50 to 99.75% made from ore or scrap. Used for casting purposes.

Best Selected.—British copper averaging 99.75% fine. Largely used in the British brass trades.

Tough.—British copper largely used for casting, rolling and drawing. Runs about 99.25%.

Chile Bars.—Copper smelted in Chile, running 95 to 99% pure, and in some cases carrying bullion.

Standard.—Practically anything running from 96% upwards dealt in on London Metal Exchange.

COPPER SHAPES

Wire Bars.—About 3 to 4″ square and 3 to 7′ long. Average weight 135 to 300 pounds. Used for wire drawing.

Ingots.—Average weight about 18 to 20 lb. Notched. Used for casting.

Ingot Bars.—Notched bars for casting. Weight about 55 to 110 lb.

Cakes.—Weight 100 lbs. and upward. Used for rolling.

Cathodes.—About 2′ by 3′ but thicker at the top than the bottom. Refined copper from the electrolytic tanks, which is run down to wire bars, etc.

REQUIREMENTS

For successful working, copper must pass another test besides that of chemical composition. The chemical composition is a necessary condition, for without it the metal would not be up to the desired standard, but the metal must have an electrical conductivity of at least 98.5% for wirebars and cakes, and 97.5% for ingots. Usually, however, it runs much higher, ranging from 100 to 101, and in some cases as high as 103.

The "pitch" or "set" is not really a test in the true sense. It is simply the appearance which gives an indication of the condition of the bar. Good bars, however, are at "tough pitch" and are a "in set." The surface of the bar is corrugated but level.

Mechanical tests, such as torsion, tensile strength, and ductility tests, have been dropped, as the fabrication of the wire introduces so many variables.‡

As indicated by the above chart, the first to receive the ore after it has left the mine (and its adjunct, the mill or concentrator) is the smelter. From there the metal, in the form of anodes or blister, goes to the refineries, where it is electrolytically refined.

A large amount of copper, however, is not electrolytically refined, since it is found in such form that it can be furnace-refined without recourse to the electrolytic process. This is the metal known as Lake Copper, mined and reduced largely in Michigan. A list of the brands of copper manufactured in the

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES.

Name.	Location.	Capacity in 1915.	Pounds† 1916.
Nichols Copper Company	Laurel Hill, N. Y.	400,000,000	450,000,000
Raritan Copper Works	Perth Amboy, N. J.	400,000,000	460,000,000
Baltimore Copper Smelting and Refining Company	Canton, Md.	354,000,000	600,000,000
American Smelting & Refining Company	Perth Amboy, N. J.	240,000,000	240,000,000
U. S. Metals Refining Company	Chrome, N. J.	200,000,000	250,000,000
Balbach Smelting & Refining Company	Newark, N. J.	48,000,000	48,000,000
Anaconda Copper Mining Company (old)	Great Falls, Mont.	65,000,000	65,000,000
Anaconda Copper Mining Company (new)	Great Falls, Mont.	.....	180,000,000
Tacoma Smelting Company	Tacoma, Wash.	120,000,000	130,000,000
Calumet & Hecla Mining Company	Calumet, Mich.	65,000,000	65,000,000
Consolidated Mining & Smelting Company	Trail, N. C.	.....	13,000,000
Tottenville Copper Company	Tottenville, N. Y.	.....	100,000,000
Total		1,892,000,000	2,601,000,000

*See THE METAL INDUSTRY, January, 1920.

†All the figures were officially furnished to The Mine Handbook (from which this list was taken) by the Engineering and Mining Journal.

‡The Requirements of Refined Copper, by Lawrence Addicks, Chemical and Metallurgical Engineering, March 10, 1920.

United States and the places where they are refined, shows the segregation of the Lake copper industry as compared with the electrolytic.

BRANDS OF COPPER IN THE UNITED STATES.

	Refined At:	Branded.
LAKE.		
Adventure	Hancock, Mich.	Adv. C. Co.
Atlantic	Houghton, Mich.	A.
Calumet & Hecla	Hubbell, Mich.	C.&H.M.Co.
Centennial	Hancock, Mich.	C. C. M. Co.
Copper Range	Houghton, Mich.	C. R.
Franklin	Hancock, Mich.	F. M. Co.
Isle Royale	Dollar Bay, Mich.	I. R. C. Co.
Mass.	Hancock, Mich.	Mass.
Michigan	Houghton, Mich.	M. C.
Mohawk	Houghton, Mich.	M. M.
Osceola	Dollar Bay, Mich.	T. O.
Quincy	Hancock, Mich.	Q. M. Co.
Tamarack	Dollar Bay, Mich.	T. O.
Victoria	Hubbell, Mich.	V. C.
Winona	Hubbell, Mich.	W. A.
Wolverine	Houghton, Mich.	W.
ELECTROLYTIC.		
American S. & R. Co.	Perth Amboy, N. J.	P. A.
Balbach S. & R. Co.	Newark, N. J.	Bb.
Baltimore Copper Works	Baltimore, Md.	B. E. R.
Boston & Montana Co.	Great Falls, Mont.	B. & M.
Chicago Copper Ref. Co.	Blue Island, Ill.	C. C. R.
Copper Queen	Laurel Hill, L. I.	C. & Q.
Miami	Laurel Hill, L. I.	A. L. S.
Nichols Copper Co.	Laurel Hill, L. I.	L. N. S.
Orford Copper Co.	Chrome, N. J.	O. E. C.
Raritan Copper Works	Perth Amboy, N. J.	N. E. C
U. S. Metals Ref. Co.	Chrome, N. J.	D. R. W.
United Metals Selling Co.	Laurel Hill, L. I.	R. M. C.
CASTING.		
Balbach S. & R. Co.	Newark, N. J.	N. B. C.
Boston & Montana Co.	Great Falls, Mont.	M. A.
Chicago Copper Ref. Co.	Blue Island, Ill.	C. C. R.
Duquesne Reduction Co.	Pittsburgh, Pa.	D. E. C.
Nichols Copper Co.	Laurel Hill, L. I.	C. N. C.
Phelps Dodge Corp.	Laurel Hill, L. I.	P. D.
Tottenville Copper Co.	Tottenville, N. Y.	C. T. C.
U. S. Metals Ref. Co.	Chrome, N. J.	D. S.
White & Bro., Inc.	Philadelphia, Pa.	W. B.

The above table is from American Metal Market.

As shown in the Table of Electrolytic Refineries, a total of 2,601,000,000 pounds of copper were refined by American refineries in 1916. In 1918, this dropped to about 2,484,000,000 pounds. It should be clear, however, that all of this is not mined in the United States. About 576,000,000 pounds were imported in 1918.

The handling of copper from the refineries to its destination, such as rolling mills, factories, etc., is in the hands of a comparatively few large selling agencies. In some cases the selling agents are merely subsidiaries of the producing company; in others they overshadow the producer, and are practically in control of his business. It should interest metal users greatly to know through just what channels their metal reaches them, and for that reason a short description is given of the most important selling companies.*

American Metal Company

Offices: 61 Broadway, New York; Oliver Bldg., Pittsburgh, Pa.; Boatmen's Bank Bldg., St. Louis, Mo.; Foster Bldg., Denver, Colo.

*Information about various selling agencies obtained by courtesy of Mr. Walter Harvey Weed, editor and publisher of The Mines Handbook, which includes also The Copper Handbook.

Officers: Berthold Hochschild, New York, Chairman of the Board; C. M. Loeb, president; Otto Susman, Henry Bruère, Julius Loeb, Ludwig Vogelstein, and Harold K. Hochschild, vice-presidents; Julian Beaty, treasurer; Julius Goldman, secretary, with Henry V. Putzel, S. Roos, and M. Schott, directors.

Trustees: Henry Morgenthau, Berthold Hochschild, J. F. Guffey, F. L. Crocker, C. B. de Camp, J. P. Grier and Ludwig Vogelstein.

Incorporated 1887 in New York as refiners, exporters, importers, and dealers in metals and chemicals. Capital, $25,000,000; $100 par; 70,000 issued. The capital in 1891 was $200,000.

For an analysis of the ramifications and connections of this company, reference should be made to the report made by the Alien Property Custodian in April, 1919. This includes the partnerships with Aron Hirsch & Sohn; Beer, Sondheimer & Co.; The Metallgesellschaft and Vogelstein & Co., the last-named being absorbed by the American Metal Co., in December, 1919, thereby controlling the U. S. Metals Refining Co. (which see below).

When the Alien Property Custodian seized the 34,644 shares of German-owned stock, these shares and all but 200 of the American-held shares were put into a five-year voting trust. This voting trust does not include 16,736 shares belonging to H. R. Merton & Co. The German-owned shares sold at public auction for $5,750,904, were bought by a syndicate, by which Ludwig Vogelstein acquired a 20% interest of 14,000 shares, making him the largest individual stockholder. The Cerro de Pasco Copper Corporation owns 4,500 shares; L. T. Haggin, 1,000; J. Horace Harding, 1,000; H. C. Frick, est., 1,000; C. D. Barney, 1,200, and E. H. Clark, 1,500 shares.

The American Metal Co. owns the following companies: American Zinc & Chemical Co., Langeloth, Pa.; Bartlesville Zinc Co., Bartlesville and Blackwell, Oklahoma; Clarkesburgh Clinkering Co., Bridgeport, West Virginia; Chanute Spelter Co., Cherokee County, Kansas; Metallurgical Co. of America, American Metal Transport Co. American Metal Company has large interests in the following: Ohio and Colorado Smelting & Refining Company, Salida, Colorado; Balbach Smelting & Refining Company, Newark, New Jersey; Nichols Copper Company, Laurel Hill, Long Island, N. Y.; South American Metal Company (The), Chile; Fundicion de Guyacan, Guayacan, Chile; Compania de Minerales y Metals, Mexico, Providencia Mines, Zacatecas, Mexico; Parrena Mining Co., Coahuila, Mexico; Cia. Mineral Paloma y Carbillas, S. A. Higueras, Coahuila, Mexico; Compania Minera Penoles, Durango, Mexico; Compani a Metallurgica de Torreon, Torreon, Mexico; Fundidora y Afinadora Monterrey, S. A. Monterrey, Mexico.

The directors of the American Metal Company voted on March 12, 1920, to increase the company's outstanding capital stock from $7,000,000 to $14,000,000 by the sale of 70,000 shares of stock at par, $100 pro rata to stockholders of record at the close of business March 15. The new shares will be issued on or about June 15 and all the stockholders will take their pro rata allotment. The company has an authorized capital of $25,000,000.

The corporation, through its subsidiaries and allied companies, produces, among other things, from 100,000,000 to 125,000,000 pounds of electrolytic copper annually.

In addition to its own production of metals, the company buys and sells metals in the open market and also contracts to take the entire output of various

mines, smelters and refineries in the United States, Canada, Mexico and South America.

The company has contracts with large mines in North America calling for their entire production, totalling 159,000,000 pounds of copper per annum. Copper received during 1918 from these and others amounted to 141,398,982 pounds. Refineries in which the company has an interest treated this metal. The entire yearly turnover of the company, in copper, is 250,000,000 pounds.

United States Metals Refining Co.

Formerly owned by United States Smelting, Refining & Mining Company, but control was secured by America Metal Company, in December, 1919.

Works: The U. S. M. R. Co. owns electrolytic copper refinery having a capacity of refining 140,000,000 pounds of copper annually, a copper smelter, consisting of two blast-furnaces, with an annual capacity of smelting 200,000 tons of charge. The copper smelter purchased its ores under long contracts with mines in Canada, Spain, Cuba, and the western coast of South America; and consequently is assured a long life, as it is not dependent on any one mine. The refinery enters into long-time contracts for the refining of other copper besides that produced by the U. S. S. R. & M. Co. These two plants are located on 159 acres of ground at Chrome, N. J. This property is at tide-water, permitting ocean-going steamers to discharge direct into the plant, and is also connected with the Central Railroad of New Jersey.

American Smelting & Refining Co.

General Offices: 120 Broadway, New York City; Corporate office: 15 Exchange Place, Jersey City, N. J.; City of Mexico office: Edificio, "La Mutua," Despacho No. 200, Mexico, D. F. Valparaiso office: Casilla 12, Valparaiso, Chile.

General Officers: Simon Guggenheim, president; Jos. Clendenin, J. K. MacGawan and F. H. Brownell, vice-presidents; Isaac Guggenheim, treasurer; F. W. Hills, comptroller; L. A. Chapin, assistant treasurer; W. R. Merriss, secretary; R. P. Reese, auditor.

Directors: L. Newhouse, chairman; Simon Guggenheim, Jos. Clendenin, Chas. Earl, Leopold Frederick, Isaac Guggenheim, F. W. Hills, Wm. Loeb, Jr., John K. MacGowan, W. S. McCornick, W. S. Moore, Walter T. Page, H. A. Prosser, E. B. Schley, John N. Steele, C. W. Whitley, F. H. Brownell, C. A. H. de Saulles, Roger W. Straus, W. M. Drury, L. G. Eakins, H. A. Guess, W. E. Merriss, F. R. Raiff, and H. R. Wagner.

Executive Committee: Simon Guggenheim, chairman; Jos. Clendenin, Chas. Earl, F. W. Hills, Wm. Loeb, Jr., J. K. MacGowan, W. S. Morse, E. L. Newhouse, H. A. Prosser, F. H. Brownell, H. A. Guess and H. R. Wagner.

REFINING PLANTS.

	Yearly Capacity			
Plant.	Gold Oz.	Silver Oz.	Lead Tons.	Copper Tons.
Perth Amboy, Maurer, N. J.	500,000	48,000,000	108,000	120,000
H. H. Alexander, Mgr. G. Griswold, Supt.				
Baltimore, Baltimore, Md.	300,000	30,000,000	.....	240,000
W. H. Pierce, Mgr. C. N. Sappington, Supt.				
Tacoma, Tacoma, Wash.	.....	.....	.....	72,000
H. Y. Walker, Mgr. G. A. Kerr, Supt.				

Copper Export Association

One of the most important selling companies in the world is the Copper Export Association, which represents almost all the large copper producers in the United States. Among its directors are the men who practically control the American copper industry. It manages all export business of its members, allocating orders, and dominates the field.

Office: 60 Broadway, New York City.

Officers: Simon Guggenheim, chairman of the board; John D. Ryan, president; Walter Douglas, 1st vice-president; R. L. Agassiz, 2nd vice-president; C. W. Welch, secretary-treasurer.

Directors: Murray Guggenheim, Simon Guggenheim and F. H. Brownell for A. S. & R. Co.; John D. Ryan, Cornelius F. Kelley and Benj. B. Thayer for Anaconda Copper Mng. Co. and Inspiration Cons. Copper Co.; Chas. Hayden, Chas. M. MacNeill and D. C. Jackling for Utah Copper Co., Nevada Cons. Copper Co., Ray Cons. Copper Co. and Chino Copper Co.; Walter Douglas and Jas. McLean for Phelps Dodge Corporation; R. R. Agassiz and Jas. MacNaughton for Calumet and Hecla Mng. Co.; Stephen Birch for Kennecott Copper Corporation; Wm. A. Clark for United Verde Copper Co.; Archibald Douglas for United Verde Extension Copper Co.; Gordon R. Campbell for Calumet & Arizona Mng. Co.

Selling Committee: Jos. Clendenin, A. S. & R.; T. Wolfson, U. Metals Selling Co.; C. A. Austin, Phelps Dodge Corpn.; F. S. Gourley, Calumet & Hecla Mng. Co., H. M. Brush, secretary; Edward Mosehauer, representative in Germany.

Incorporated: December, 1918, in Delaware. Cap. 2,500 shares, 7 per cent Pfd., par $100, also 500 shares common, no par value. Annual meeting May 13.

The object of this corporation is to handle export sales of copper on a basis whereby orders for export copper will be allocated to members according to production and at the same price, f. o. b. seaboard. All producers of copper, large or small, are invited to join on the same terms. It is stated that over 80% of American production, 1,800,000,000 pounds copper during 1918, is represented in this corporation.

The members own the indicated percentage in the plants named:

Anaconda Copper Mining Company
- Refineries:
  - 100% Great Falls, Mont.
  - 100% Raritan Copper Works, Perth Amboy, N. J.
- Metal Selling Agencies:
  - 100% United Metals Selling Company.

American Smelting & Refining Company
- Refineries:
  - Perth Amboy, N. J.
  - Baltimore, Md.
  - Tacoma, Wash.

Inspiration Consolidated Copper Company
Green Cananea Copper Company
Ray Consolidated Copper Company
Chino Copper Company
Nevada Consolidated Copper Company
Utah Copper Company
Phelps Dodge Corporation
- Selling Agents for the various Phelps Dodge Companies and Smelters.

Calumet & Hecla Mining Company
- Refinery:
  - Torch Lake, Centennial Copper Company.

Kennecott Copper Corporation
- Copper Mining:
  - 99% Braden Copper Company, Chile.
  - 38% Utah Copper Company.

Alaska Developing & Mining Company

A. Lewisohn & Son: General Development Company
United Verde Copper Company
Refinery:
Clarkdale, Ariz. (converter plant).
United Verde Extension Mining Company
(Closely connected through stockholders with Phelps Dodge Corporation).
Refinery:
Verdy, Arizona (converter plant).
U. S. Smelting, Refining & Mining Company
Refinery:
At Chrome, N. J.
Calumet & Arizona Mining Co.
United Metals Selling Company
Selling Agents for Anaconda Copper Mining Company and allied interests.
Tennessee Copper Company
Sales Agents:
Represented by American Smelting & Refining Company.
Arizona Copper Company, Ltd.
Consolidated Copper Mines Company
International Smelting Company
Owned by Anaconda Copper Mining Company.
New Cornelia Copper Company
Subsidiary of Calumet & Arizona Mining Company. Electrolytic Refinery, Agency, Arizona.
North Butte Mining Company
International Metals Selling Company
Subsidiary of the U. S. Smelting, Refining & Mining Co., and was managed by Vogelstein & Co., 42 Broadway, New York, which was absorbed in December, 1919, by the American Metal Co., Ltd.
International Smelting Company
Office: 42 Broadway, New York.
Officers: Cornelius F. Kelley, president; Wm. D. Thornton, 1st vice-president; L. D. Ricketts, 2nd vice-president; Albert H. Melin, treasurer; with C. E. Mills, Benj. B. Thayer, and John D. Ryan, directors. David B. Hennessy, secretary. J. B. Whitehill, ore purchasing agent.

Incorporated in Montana. Capital $15,000,000. Stock entirely owned by Anaconda Copper Mining Co. Company is a reorganization of the International Smelting and Refining Co.

Company operates smelters at Tooele, Utah, and Miami, Ariz., the Raritan Copper Works at Perth Amboy N. J., and the smelter of the International Lead Refining Co., at East Chicago, Ind.
International Smelting & Refining Company
Properties and assets: Purchased 1914 by Anaconda Copper Mining Co., for $10,392,709. Company dissolved and properties transferred to the International Smelting Co., and described thereunder.

Copper Finance Corporation

In 1920, the Copper Finance Corporation was organized, capitalized at $50,000,000, to provide a revolving fund to handle over 500,000,000 pounds of copper to be sold to foreign countries. The corporation is closely allied with the Copper Export Association, and was formed to supply the long term credits necessary to finance European shipments, with the lately warring nations in the financial condition that they are. This will undoubtedly help to bring the copper properties back to normal production as compared with the 50 per cent curtailment which exists at present.

From the large selling agencies the metal goes either to the larger manufacturers and to jobbers. The smaller manufacturers generally obtain their new copper through the jobbers or the metal brokers.

A list of some of the prominent firms from whom copper can be purchased in small lots is as follows:

Ajax Metal Company, Philadelphia, Pa.
American Alloys Company, Baltimore, Md.
S. Birkenstein & Sons, Chicago, Ill.
Clendenin Brothers, Baltimore, Md.
Coates, Bennett & Reidenbach, Rochester, N. Y.
Hendricks Brothers, New York City.
C. W. Leavitt & Company, New York City.
Tottenville Copper Company, Tottenville, N. Y.
Balbach Smelting and Refining Company, Newark, N. J.
Baltimore Copper Smelting & Rolling Company, Baltimore, Md.
Richards & Company, Boston, Mass.
United American Metals Corporation, Brooklyn, N. Y.
White & Brother, Inc., Philadelphia, Pa.
United States Smelting, Refining and Mining Company, New York City.

The larger users, and approximately the amounts they consume are as follows:

Companies	Monthly lb.	Per Annum lb.
American Brass Company ...	25,000,000	300,000,000
Buffalo Brass Branch, American Brass Company.....	12,000,000	144,000,000
Chase Rolling Mills.....	12,000,000	144,000,000
National Conduit & Cable Company	10,000,000	120,000,000
Detroit Copper & Brass Company	8,000,000	96,000,000
Scoville Manufacturing Company	8,000,000	96,000,000
Roebling Sons Company.....	6,000,000	72,000,000
Standard Underground Cable Company	6,000,000	72,000,000
Bridgeport Brass Company..	6,000,000	72,000,000
Rome Brass & Copper Company	6,000,000	72,000,000
American Electrical Works & Phillips Insulating	6,000,000	72,000,000
American Copper Product Company	4,000,000	48,000,000
Baltimore Copper Smelting & Refining Company.....	4,000,000	48,000,000
Seymour Manufacturing Company	3,500,000	42,000,000
American Steel & Wire Company	2,500,000	30,000,000
Michigan Brass Smelting and Refining Company	2,000,000	24,000,000
Flume & Atwood	1,500,000	18,000,000
Bristol Brass Company.....	1,250,000	15,000,000
Baltimore Tube Works	1,000,000	12,000,000
Taunton-New Bedford Copper Company	1,000,000	12,000,000
Randolph-Clowes Company ..	1,000,000	12,000,000
C. G. Hussey Company.....	1,000,000	12,000,000
Stamford Rolling Mills	1,000,000	12,000,000
Hendricks Brothers	750,000	9,000,000
Micellaneous	6,500,000	78,000,000
Total	136,000,000	1,632,000,000

From these manufacturing companies, the copper, now in the form of manufactured or fabricated product, passes to the merchandising or marketing organization, which in turn passes it on to the consuming public.

British Aluminum Foundry Practice

An Exposition of the Methods of Handling Aluminum in the Foundry from the Ingot to the Finished Product. Part 2*

POURING TEMPERATURE.

The temperature of pouring has a very marked effect upon the quality of aluminum castings. In general, the temperature should be as near the melting point as possible, and it is found that an increase in tensile strength in both yield point and elongation. The effect of pouring is strikingly illustrated in Table I, which shows the average results of tests made on a large number of alloys.

As a general rule 1,200° F. (650° C.) may be taken as a safe value for the pouring temperature of all the common alloys. Below this figure there is little improvement and the strength and the risk of imperfect castings is increased.

TABLE I.—EFFECT OF POURING TEMPERATURE OF ALUMINUM ALLOYS.

		Poured at Low Temperature.		Poured at High Temperature.	
No.	Alloy Composition.	Pouring Temp. Deg.F.	Tens. Strength in lbs. per sq. in.	Pouring Temp. Deg. F.	Tens. Strength in lbs. per sq. in.
1	Pure Al.	1,400	10,500	1,600	8,000
2	2 Cu.	1,225	13,800	1,600	11,500
3	4 Cu.	1,225	15,500	1,600	13,000
4	6 Cu.	1,225	17,600	1,600	14,500
5	8 Cu.	1,225	20,000	1,600	15,500
6	10 Cu.	1,225	21,000	1,600	16,000
7	12 Cu.	1,225	22,500	1,600	17,500
8	4 Zn.	1,225	13,000	1,550	10,000
9	8 Zn.	1,225	17,000	1,550	12,700
10	12 Zn.	1,225	21,000	1,550	14,000
11	16 Zn.	1,225	24,000	1,550	17,000
12	20 Zn.	1,225	27,000	1,550	20,000
13	24 Zn.	1,225	30,000	1,550	24,500
14	28 Zn.	1,225	33,000	1,550	27,500
15	32 Zn.	1,225	35,000	1,550	30,000
16	36 Zn.	1,225	37,000	1,550	33,000
17	1¼ Cu., 30 Zn.	1,225	42,000	1,550	34,000
18	2 Cu., 10 Zn.	1,225	33,000	1,550	15,500
19	2½ Cu., 19 Zn.	1,225	33,000	1,550	25,000
20	2 Cu., 22 Zn.	1,225	36,000	1,550	28,000
21	2 Cu., 25 Zn.	1,225	37,000	1,550	33,000
22	3 Cu., 3 Zn.	1,225	17,000	1,550	13,000
23	3 Cu., 6 Zn.	1,225	19,000	1,550	13,500
24	3 Cu., 12 Zn.	1,225	26,000	1,550	18,500
25	3 Cu., 15 Zn.	1,225	28,500	1,550	19,500
26	3 Cu., 15 Zn., ½ Mn.	1,225	30,000	1,550	20,000
27	3 Cu., 25 Zn.	1,225	37,500	1,550	29,500
28	4 Cu., 8 Zn.	1,225	23,500	1,550	15,500
29	4 Cu., 15 Zn.	1,225	32,000	1,550	23,000
30	5 Cu., 10 Zn.	1,225	24,000	1,550	18,500
31	6 Cu., 5 Zn.	1,225	20,000	1,550	15,000
32	7 Cu., 3 Zn.	1,225	19,500	1,550	15,500
33	7 Cu., 9 Zn.	1,225	25,000	1,550	18,000
34	7½ Cu., 1 Zn.	1,225	18,000	1,550	14,000
35	8¼ Cu., ¼ Zn.	1,225	20,000	1,550	17,000
36	8 Cu., ½ Zn.	1,225	20,500	1,550	17,000
37	2 Mn.	1,200	19,000	1,550	18,500
38	8 Cu., ¼ Mn.	1,200	20,000	1,500	17,500
39	7 Cu., ½ Mn.	1,200	19,000	1,500	16,000
40	6 Cu., ½ Mn.	1,250	18,500	1,500	16,500
41	4 Cu., 1 Mn.	1,250	16,000	1,500	15,000
42	8 Cu., 2 Sn.	1,215	18,000	1,475	15,750
43	5 Cu., 3 Sn.	1,215	16,800	1,500	15,000
44	6 Cu., 1 Ni.	1,300	18,200	1,600	14,500
45	8 Cu., ¼ Ti.	1,250	19,000	1,500	18,400
46	8 Cu., ¼ Cr.	1,200	19,500	1,500	15,900
47	8 Cu., ¼ Sb.	1,250	20,000	1,500	17,400
48	8 Cu., ¼ Vd.	1,250	20,000	1,500	18,500
49	8 Cu., ¼ Cd.	1,250	18,600	1,500	15,800
50	8 Cu., ¼ Bi.	1,250	18,000	1,500	14,000
51	4 Cu., 4 Ag.	1,300	19,700	1,550	15,400
52	8 Cu., 1½ Fe., ¾ Si.	1,250	21,000	1,500	18,000
53	5 Mg.	1,250	20,500	1 400	20,000

amounting to two tons per square inch is to be obtained by adhering to this rule. The improvement in tensile strength is with most alloys accompanied by an increase

It is difficult, if not impossible, to estimate even roughly the temperature of molten aluminum by the eye,

*From Aluminium Foundry Practice, a booklet published by the British Aluminium Company, Limited, London, England. For Part 1, see The Metal Industry April 1920.

and the most progressive factories now pour aluminum under strict pyrometric control. The temperature of pouring chosen for each alloy is the lowest possible value for the prevention of solidification before air trapped in pouring is driven out.

Overheating in itself is not injurious providing the metal is allowed to cool down to the correct temperature before pouring, but it must be remembered that overheating in an open type of furnace is generally accompanied by rapid oxidation, and an absorption of nitrogen, and this, of course, has a very bad effect.

It is found that better castings are obtained by allowing the metal to cool naturally to the pouring temperature than by cooling it quickly by adding pieces of unmelted metal. On the other hand, care must be taken to prevent the oxidation which may occur if the metal is left standing for any length of time.

The dross which forms on the surface must be removed with special care, as it is liable to remain under the surface and pass into the casting. The skimming should be done with a degree of thoroughness not usually applied to other metals, and any good metal which is removed with the dross can be reclaimed by melting up the skimmings and running the metal so obtained into an ingot for later use.

FINISHING.

Aluminum castings are characterized by the cleanliness with which they come from the molds, and for many purposes no finishing treatment whatever is necessary. Where a very smooth product is required, scratch-brushing or sandblasting are recommended, and a perfectly white color may be imparted by dipping in a bath of caustic soda, followed by a nitric acid dip.

Risers and runners are usually removed by means of a wood band saw having about four teeth per inch. Such a saw is less liable to clog than the fine-toothed metal saws.

Shrinkholes, pinholes, and other surface defects may be repaired in a very satisfactory manner by means of an oxy-acetylene blowpipe, and the casting thus repaired is quite as strong and reliable as one cast perfectly. After the repaired portion is cleaned up and the excess metal removed it should be quite impossible to distinguish the welded part from the rest of the casting.

Polishing after casting is readily accomplished by tumbling with steel balls. For large articles for which this method is not applicable the ordinary emery and mop finishing processes are employed.

ALLOYS FOR CHILL AND DIE CASTINGS.

The ability to produce clean castings in aluminum alloys having all the desirable properties of brass with none of its disadvantages, has led to the use of this metal for all kinds of fittings and parts of machines where previously brass or white metal was used.

Such parts are usually required to be accurate to size, to require little or no machining, and to be turned out in quantity, and this has led to the use of metal molds in place of sand and to the designing of the mold to give a finished article true to gauge, free from blowholes, and capable of being rapidly filled and emptied without intermediate cooling. In addition to the advantages of quick and accurate castings, most aluminum alloys, when cast in chill molds, present superior properties to those obtained when cast in sand, owing to the more rapid cooling, though the temperature at which the metal is cast materially affects the results. Alloys containing manganese show to an unusual extent this phenomenon of increased tensile strength with better ductility when chill cast.

Practically all the standard aluminum alloys used in the foundry can be successfully cast in chill molds, but certain classes of alloys—notably those high in copper and low in zinc—give the best results. The usual run of foundry alloys high in zinc—especially if ordinary commercial zinc is used—are not suitable for casting in metal molds, as they absorb iron from the molds, are difficult to remove when set, and are particularly liable to "hot shortness," leading to cracks in cooling, owing to the lack of give in the metal molds as compared with sand molds.

Table II shows a few typical alloys suitable for casting in chill molds, with their principal properties, both as sand and as chill castings. The figures given are fair average results to be expected in ordinary foundry practice, giving a careful control of the casting temperatures, but some variation above and below these figures must be expected in accordance with the degree of purity of the metals used. These figures are based largely on the results obtained by the Alloys Research Committee and given in their various reports on light alloys.

The alloy containing 92 per cent. aluminum and 8 per cent. copper is very popular for die castings made under pressure, since this particular alloy provides a practical compromise between the conflicting requirements of low melting point, high tensile strength and ductility, at temperatures just below the solidification point.

TABLE II.—PROPERTIES OF ALUMINUM ALLOYS FOR CHILL AND DIE CASTINGS.

No.	Composition			Mold	Yield Point Tons	Ultimate Tensile Strength Tons	Elongation On 2 ins.
	Al.	Cu.	Mn.				
1	96	4	—	Sand	5.0	7.5	1.0%
				Chill	5.5	9.5	2.5%
2	94	6	—	Sand	6.0	7.5	1.0%
				Chill	6.0	10.0	1.5%
3	92	8	—	Chill	6.0	9.0	1.7%
				Chill	6.0	11.0	2.5%
4	90	10	—	Sand	6.0	9.5	1.5%
				Chill	6.5	11.5	2.5%
5	96	2	2	Sand	6.0	8.5	4.0%
				Chill	6.2	9.0	5.0%
6	95	4	1	Sand	6.0	7.5	4.5%
				Chill	7.0	10.0	5.0%

COTHIAS DIE-CASTING PROCESS.

The process of casting under mechanical pressure in metal molds, with either metal or sand cores, is particularly applicable to large castings where a good finish is required, combined with good mechanical properties and freedom from blowholes and other irregularities. It is largely used for thin-walled castings of more or less open shape and is not applicable to complicated "box" castings with inside cores. The principle employed is to make the top and bottom of the mold two separate units, the top half containing the cores. The exact quality of metal is then poured into the lower half of the mold, previously preheated to a suitable temperature, and the top part forced down into the bottom, making a metal-tight point. The metal thus becomes compressed between the two halves of the mold and is forced into all the corners and intricacies of the pattern. This method of casting under pressure is applicable to practically all the standard aluminum, and is largely used in casting such parts as crank-cases, gear-boxes, cylinders, pistons, etc., for motor car and areoplane motors.

DIE CASTING.

In the more usual process of the die casting the metal is forced into metal molds under pressure applied either by means of a plunger pump or by means of compressed

air. Only alloys of comparatively low melting point can be successfully cast by this method, but the finished castings are extremely accurate and free from all irregularities.

For castings not exceeding 1 inch in any direction an accuracy within 0.0005 in. may be obtained, while for large castings .005 in. is a common tolerance. The most intricate shapes can be made with properly designed dies, all castings are exactly alike, the outlines are sharp and the surface smooth and capable of taking a high polish without intermediate machining.

As in the case of chill castings, the rapid cooling results in a considerably higher tensile strength than that obtained with the same alloy when sand cast. The pressure applied accentuates this effect, and with die castings the metal is exceedingly close grained and very tough. The compactness of the crystalline structure has often an appreciable effect upon the specific gravity of the alloy, and in one test upon a large number of bars of the same composition cast by the two methods the average specific gravity of sand cast bars was 2.84, while, when die cast, the specific gravity increased to 2.87.

The precision in die-casting allows of a considerable diminution in the thickness of the castings, 20 to 25 per cent. being commonly saved in the weight.

Die castings of 30 lbs. each are now being turned out in large numbers, and it is interesting to note that an iron sand casting for the same article would weigh nearly 1 cwt. The majority of aluminum die-castings, however, are for small parts for automatic machines, typewriters, cash registers, gas and electric meters, water circulating and force feed pumps, magnetos, counting machines, etc. A recent development is the production of pistons and other parts for automobile and aeroplane engines by this means.

DIE CASTING MACHINES.

The main features of die casting machines are similar in all designs. The metal is contained in a lined metal crucible fixed inside a gas or oil heated furnace. Passing down into the molten metal is a tube of refractory material which is connected at the upper end with a nozzle through which the metal is forced into the mold. A sprue-cutting device cuts off the molten metal at the nozzle when the casting has been completed.

For aluminum die-casting the most successful method of forcing the metal upwards into the dies is by the use of air pressure. The crucible is fitted with an airtight cover and is connected through a valve with a cylinder of compressed air. By simply opening this valve a very great pressure may be suddenly applied to the molten metal, forcing it through the nozzle into all the interstices of the most complicated dies.

This process has to some extent superseded, for aluminum, the use of the earlier cylinder and plunger type of machine, and with the better method from 100 to 250 castings may be produced per hour.

DIES.

The design and construction of the dies constitute one of the most vital factors in the successful operations of the process. In many cases the die-designer must entirely re-design the part to conform with the process, while on the other hand a machine part pronounced a casting impossibility may often be made a possibility by the ingenuity of the die designer.

The chief difficulty lies in the necessity for quickly removing the finished casting from the dies. Generally the designer is forced to use a number of loose pieces as cores, or chills, or for the formation of projecting parts, which if not formed by this method would interfere with the opening of the mold. In many cases collapsible cores are employed, but these are apt to lead to further complications and, moreover, add greatly to the cost.

HAND FINISHING CAST ALUMINUM AUTOMOBILE PANELS.

Owing to the thinness of the metal the castings are sometimes warped, but the ductility of the metal permits them to be hammered into the true form, after which they are hand finished by filing and drawing, and afterwards polished with emery cloth ready for painting.

The dies are, as far as possible, mechanically operated so that the cores are removed, the dies opened, and the casting removed in the least possible time and with the least expenditure of labor. The saving of time is important, not only because of the cost, but because the life of the dies is increased if the time interval between the castings is not sufficient to allow much variation in temperature.

Careful allowance for shrinkage must be made, and the location of the gates and vents carefully planned. The gates may be small since the pressure applied ensures a rapid filling of the mold, and it is advisable to so place them that they will not show on the finished part after they have been filed off. Vents are indispensable, although the spaces between the die faces serve to remove trapped air. Sometimes fine spaces are left for

the purpose. It is essential to make some definite arrangements of the kind, although the vents need only be very small in area owing to the high pressure employed.

The number of castings that can be produced with one set of dies varies according to the nature of the work and the properties of the steel, of which the dies are made. Chrome vanadium steel is generally used. It is claimed that some of the dies now in use have produced over 75,000 castings without perceptible wear or injury, but such figures cannot be relied upon for every case, and from 5,000 to 10,000 castings would, in general, be a safe figure to take.

The importance of the dies may be understood by considering the usual die costs. For simple parts dies may cost from £10 to £20; for more intricate parts £20 to £30 is not uncommon, while for very complicated parts the die cost may run as high as £100. Although the latter figure seems high, castings from such a die still show big savings, since otherwise there would be no demand for such dies.

In many cases, of course, the cost of the dies prohibits the use of the method, but for a large number of similar parts which would require difficult or numerous machining operations, necessitating a number of different settings of machine tools, the cost of the dies is very quickly set off by economy in time and labor and the saving of spoilt work.

In the construction of dies none but highly skilled mechanics should be employed. Inferior labor is a false economy, as a single false step may ruin weeks of costly work.

METHOD OF DIE CASTING ALUMINUM

The metal to be melted is first put into the crucible and the furnace lighted. The temperature of the furnace should be so adjusted that the alloy is kept at a uniform temperature just above the melting point.

The dies, having been assembled and fixed to the machine over the nozzle, are now carefully heated by a blast brazing burner or an ordinary bunsen burner made out of 1 inch piping. The sprue-cutting bar is now put into position so that the metal cannot pass through the nozzle, and the valve connecting with the cylinder of air is opened.

To make a casting the sprue-cutting bar is pulled back, thereby opening the nozzle and allowing the air pressure to force the molten metal into the dies. When the mold is full the sprue-cutting bar is again pushed forward, stopping the further flow of metal, and with hardly a moment's pause the die should be opened and the casting removed while still hot.

The dies should be cleaned out occasionally by a hot air blast, and to protect the surface of the mold and facilitate the extraction of the casting the dies should be lubricated after two or three operations. Beeswax, Russian tallow, and lard oil mixed with plumbago are all used for this purpose.

What Is "Aluminum?"

A Discussion of an Important Legal Question

Written for The Metal Industry by ERNEST V. PANNELL, British Aluminium Company, Ltd.

Quite recently an important ruling was handed down by a State Supreme Court; a ruling which would seem to be so greatly at variance from common understanding between buyers and sellers of metals as to call for some comment.

The case arose out of a contract by which "A" agreed to supply and "B" agreed to buy a quantity of "aluminum rods." With any dispute arising out of the business side of the contract it is not necessary to deal but an important point arose by which it appeared that the rod aluminum in question was an alloy containing only 86½% aluminum. The main issue considered by the jury and on which the verdict rested was whether "rod aluminum" meant "pure aluminum" or whether it was satisfied by the above mixture. The decision handed down and confirmed was that "rod aluminum" did not mean "pure aluminum."

Now aluminum is not essentially different from other metals; it has metallic properties and it forms alloys with quite different metallic properties. In this way it is similar to Copper, Zinc, Nickel or almost any non-ferrous metal. It is bought and sold in the same way and for similar purposes.

Suppose B buys a lot of copper rods from A and receives a shipment which analyzes 86½% copper. Would this be acceptable as copper within the meaning of the contract? Assuredly not. "Copper" failing more particular designation, would be taken to mean "commercial copper" of at least 99½% purity. A mixture containing only 86½% copper would be a brass or bronze; in other words it would have ceased to be the material contracted for. A fact not always recognized by the uninitiated is that an alloy is physically and chemically something quite different from either of the elements in it; it therefore follows that the alloy must be different commercially also.

This reasoning is perfectly applicable to aluminum. "Commercial purity" is understood as being not less than 98% as reference to market prices in any trade paper or scrutiny of current market transactions will show. Except where some other purity is designated a person who buys "aluminum" should receive metal of the 98% minimum grade.

Now it might be argued that "rod aluminum" is understood as being always made up in the 86½% alloy and never in any other purity and that this is well known in the trade. This argument cannot be sustained because the writer has been concerned in the manufacture and sale of many carloads of rod aluminum at 99% purity. Other compositions of "rod aluminum" are supplied for welding purposes also for deoxidizing. Such material is of course sold as being of a specific composition and not as "aluminum."

It is an unfortunate fact that the alloys of aluminum with a few exceptions have no names and whereas Brass and Bronze are everywhere recognized as being something quite different from Copper, aluminum and its alloys are confused as being somewhat similar. This is entirely wrong. Aluminum alloys are different from pure aluminum just as brass is different from copper and when a buyer calls for number twelve or number six or number fifteen S, he recognizes this fact, and specifies what he wants. But to the average man it would be better for common names to be attached to these different compositions which would extend the patent alloy nomenclature such as Duralumin, Magnalium, Huron Metal, etc.

Expressions of opinion from our readers will be welcomed. We believe that this question is one of utmost importance and that the metal trades should make their stand clear.—Ed.

Overcoming Plating Troubles

Some Suggestions for Eliminating Difficulties the Plater Often Encounters*

By H. C. BERNARD, Oakley Chemical Company, New York City

This paper was not written with the intention of it being of value to the experienced plater. Rather was it prepared with the idea that it might contain some helpful hints for those not thoroughly familiar with plating room problems. And because the subject is too broad to be covered in a short article I shall endeavor to cover only the most important points concerning the problems met in the plating room, and mention only those plating solutions most used in the average plating shop.

The troubles usually encountered can generally be traced to one or more improper conditions that are apt to prevail where eternal vigilance is not the slogan of the man in charge. If there was ever need for constant inspection in a shop, it is particularly true with reference to the plating outfit, for it is the source from whence trouble may be expected to develop at almost any time. These troubles may be of an electrical, chemical or physical nature.

Because it is very often the cause of trouble in plating, and the one most easily traced, electrical equipment should be the first thing that is examined in order to make certain that connections are not loose, burned off, corroded, or broken. The generator should also be carefully examined to see if the brushes are clean and in good contact with the commutator. Negligence in this matter will often result in poor plating. When poor electrical, chemical or physical conditions exist, it is next to impossible to secure good results in plating. Among the faults arising from these sources are insufficient amount of metal deposited in the proper length of time, poor color and character of the deposit, and blistering or peeling.

A portable pocket voltmeter will aid materially in locating electrical troubles. By placing one of the terminals of the meter on the positive tank rod, and one on the negative rod, it will show whether the proper voltage is being delivered to that point or not. If the voltmeter shows a reading of considerably less volts than the generator is capable of producing, you may be sure that something is wrong with either the wiring, the connections, or the generator. To find the exact location of the trouble, one must go over the wiring, until the cause of the trouble is found. It is well to test the generator however, before going over the wiring, to make certain that it is working properly. To test the generator follow the procedure as used in testing for voltage at tank rods, by connecting terminals of voltmeter to main wires or leads running from the generator to the bus bars. Should the voltmeter tests show everything to be in good working order and trouble is still experienced in securing desired deposits, it will be necessary to search further for the cause.

The chemical and metallic contents of plating solutions, if not kept well balanced, will cause a great deal of trouble when it comes to getting good plating results. Owing to plating baths constantly changing in their chemical make-up through electrolysis, it becomes necessary to frequently make additions of the proper chemicals in the correct proportions to keep them working properly. Too little or too much of any of the materials needed in plating solutions can cause trouble, therefore it is of the utmost importance to exercise extreme care when adding chemicals to them.

*From Oakite News Service, April, 1920.

NICKEL PLATING SOLUTIONS

Some of the common ailments arising from an impoverished or overloaded condition of nickel plating solutions are as follows:

Dark and clouded nickel deposits usually indicate the plating bath to be alkaline. This solution should either be neutral or slightly acidulated. To overcome alkaline conditions add a few fluid ounces of sulphuric to each 100 gallons of nickel solution, until it tests out neutral or slightly acid. Test solution with pieces of blue litmus paper. When solution reaches the neutral point there will be no change in color of the litmus paper, but if enough acid is added to the solution to just acidulate it, blue litmus paper will turn faintly red on being dipped in it.

Too much acid in the bath will turn blue litmus to a pronounced red color. An alkaline bath turns red litmus paper blue.

Too acid a condition in a nickel solution produces hard and brittle deposits that are likely to peel or blister while being buffed. To overcome this acid condition, add liquid ammonia in the same manner that acid is added to a solution until tests with a piece of blue litmus paper show it to be either neutral or but slightly acid. When adding either acid or ammonia, it is always necessary to stir the plating solution before testing with litmus paper. Stir very carefully so as not to cause the sediment in the bottom to rile up the solution. If sediment is distributed it will float through the solution and settle on the work being plated, causing pit marks to show in the deposit. In case sediment is stirred up, allow solution to stand until the sediment settles again to the bottom before using solution for plating.

Another cause for a pitted deposit is insufficient metal in solution. To remedy this, add about two ounces of nickel sulphate to each gallon of solution. Dissolve nickel salts in hot water, using just enough water to take up all of the salts.

A very dark rough deposit indicates that too great a current was used in plating the work. This condition is called "burning." To prevent burning, decrease current by means of a switchboard or rheostat, made up with nickel, silver or steel wires, so arranged as to introduce resistance in the plating circuit.

When a deposit of nickel is easily cut through to the base metal while being buffed, it may mean that not enough current was used to plate with. From 2 to 3 volts should be used for still nickel plating, and from 4 to 6 volts for barrel plating. Barrel plating requires higher voltage than still plating, on account of there being greater resistance to overcome when using this method to nickel plate small articles.

Cold or hot cyanide copper solutions give very little trouble ordinarily, but at times they will go wrong. For instance, if they contain too much cyanide and a strong current is used in plating, a blistered or peeled deposit will result. Adding copper carbonate mixed with water will reduce the amount of free cyanide in the solution and increase the metal content; this usually eliminates blistering.

When there is not sufficient cyanide in the solution, the anodes become coated over and the deposit coming from the bath shows a dark muddy appearance. If cyanide is not added to a copper solution occasionally, the anodes become so coated as practically to insulate them.

so that the current cannot pass through, eventually preventing the plating process from going on.

A rough granular copper deposit is the result of too much current being used in plating. A few ounces of hyposulphite of soda added to each 100 gallons of cyanide copper solution will brighten the deposit to a great extent.

If physical conditions, such as temperatures of plating solutions and cleaning baths are right, and the proper amount of anode surface is exposed in the plating solutions, no trouble will come from these agents. In most cases the temperature of plating solutions should be maintained at or around 70 to 80 deg. Fahr., with the exception of hot cyanide copper solutions. These should be worked at a temperature of 150 to 180 deg. Fahr.

BRASS SOLUTIONS

Brass solutions are the most difficult to keep in good running order, because they contain two metals in solution, namely, copper and zinc. This makes them more complicated and harder to manage than solutions containing only one metal in solution. Therefore, great care should be exercised in making additions to brass plating solutions, as they are easily upset from too large doses of any of the materials used in making and maintaining them.

A muddy, streaky deposit from a brass solution shows insufficient cyanide in solution. A reddish shade of the deposit indicates that the solution requires carbonate or cyanide of zinc, or ammonia. A pink looking deposit denotes too much zinc or not enough copper in the solution. A dull greyish deposit from a brass solution indicates too much cyanide in solution, or too much current being used to plate with. A few fluid ounces of liquid ammonia will sometimes work wonders in bringing about a good brass color to the deposit, providing the solution is otherwise in good working condition.

SILVER SOLUTIONS

Silver solutions require very little attention in the way of additions, occasionally silver chloride or silver cyanide together with sodium or potassium cyanide, is needed to replenish them. Silver solutions give very little trouble unless foreign materials are allowed to get into them, and good results can generally be expected if the proper amount of current is used. From ¾ to 2 volts are used in silver plating, according to the kind of work to be plated, and the number and size of the pieces placed in the plating tank at one time.

Too much current causes the deposit to burn, making it very rough. A burned silver deposit presents a dark brownish appearance when taken from the plating solution. A revolving wire scratch brush will remove the dark shade, but the roughness will remain. This interferes with the proper finishing of the surface, if the plated articles are to be subsequently polished or burnished.

In concluding this paper I will mention some things that it may be well to remember when confronted with plating troubles.

Never add chemical salts of any kind to a plating solution without having first dissolved them or mixed them thoroughly with hot water. Chemical salts insoluble in water that are intended for a cyanide bath require a hot cyanide solution to dissolve them.

The chemical salts used in acid plating baths are soluble in hot water.

When carbonate of copper is added to a cyanide solution to reduce the free cyanide in it, mix the copper carbonate with water only.

Best results are obtained with combination copper plating and cleaning solutions when used at a temperature of from 170 to 180 deg. Fahr.

Always add chemicals to plating baths in small quantities until the desired results are obtained, then stop adding.

When deposits are not up to standard be sure that the electrical conditions are right before you make additions of chemicals to the plating solutions. Very often poor results attributed to the plating solution are the result of defective current conditions, and not the fault of the plating bath at all.

LAST BUT NOT LEAST

Last, but not least, do no forget that in plating as well as in other ways, cleanliness is next to godliness, and be sure to have all work, to be plated—CLEAN.

Nickel Plating Aluminum*

By JAMES W. HANLON

The successful nickel plating of aluminum undoubtedly presents one of the most perplexing and difficult problems to most platers. Many methods of nickel plating aluminum are being used today, and what follows is not intended as a solution of difficulties some may have experienced, but merely to relate some of my own experiences in overcoming trouble in nickel plating both sheet and cast aluminum, in the hope that this experience may prove helpful to others, I have tried a number of methods and materials, but I found that most of the cleaners attacked the aluminum or rather oxidized the aluminum, thereby causing the nickel to peel.

Aluminum, like zinc, is very susceptible to, and is readily attacked by strong alkaline cleaning solutions. So after trying a number of different ways of cleaning, I found the most effective method was to clean the aluminum first in gasoline, then dry in sawdust, after which the articles were wired or racked on iron wires or racks, rinsed for one-half minute in a solution composed of six ounces of soda ash to one gallon of water heated 150 deg. Fahr., rinsed in cold water and then dipped into a solution composed of 2 ounces of perchloride of iron (lumps) dissolved in one gallon of water, allowed to remain for one to two minutes, then put directly into the nickel solution. Take care to have the current of 2 to 3 volts turned on before putting the work in, also have the cathode rod agitating about 20 revolutions to the minute, which prevents burning.

A five to ten minute plate with this method is all that is usually required on aluminum to have a satisfactory finish, after which the article is removed from the tank and dried as usual.

Should any peeled work result from carelessness such as allowing the work to strike the side of the tank or work rod or allowing the work to remain too long in the air after leaving the iron dip, I have found that a very easy way to strip the nickel off was, to put the work in ordinary bright dip composed of one-half gallon of sulphuric and one-half gallon of nitric acids with a little salt, as these acids do not affect the aluminum. The nickel is stripped off without injuring the surface of the work other than oxidizing it a trifle, which can readily be removed with a small color buff.

(Read at Chicago Branch banquet, February 28, 1920.)

*The Monthly Review, March, 1920.

Metal Mirrors for Searchlights

The Manufacture of Metal Mirrors to Replace Silvered Glass*

By R. B. HUSSEY, Arc Lamp Engineering Department, General Electric Company, Lynn Works

When the question of developing a new type of searchlight for the use of American Forces was put up to this company one of the important features that was brought forward was that of a metal mirror in place of the usual silvered glass mirror. Such a mirror had not been commercially manufactured up to this time. There were numerous reasons why such a development was much needed. In the first place, glass mirrors of the size under consideration, 60 inches in diameter, were very expensive articles, costing approximately $1,000 each, and were manufactured by only one or two concerns in this country. Further, a glass mirror is easily cracked and ruined from the heat of the arc, particularly where arcs of high current, 200 amperes or over, are being considered, as was the case. In war service a single bullet would ruin a glass mirror, while a metal mirror could be riddled with bullets and still be a usable device. These considerations led the officers of the Engineer Depot to request the commercial development of a metal parabolic mirror that could be used with the large arc searchlights.

A spun or pressed metal reflector was entirely out of the question, as it proved to be impractical to make one with the necessary accuracy of curvature. The grinding of a parabolic curve of this size is necessarily a difficult operation requiring considerable equipment and experience, so that any method involving the development of a paraboloidal surface seemed to be inadvisable. The idea was advanced that a glass mirror might be used as a form to obtain the desired curvature and polish, and the mirror could be removed and the form used over again. A large number of experiments were made on small glass reflectors depositing silver on the glass surface and then after backing with different materials removing the silver from the glass. This seemed to give promise of success, and experiments were carried out with larger sizes of reflectors in this general manner. The limit of 150 pounds in weight for a 60-in mirror set by the army engineers restricted the kind and amount of material that could be used and made the requirements very severe. As only the outer surface of the glass form was used it was found practical to obtain glass forms that were in the rough on the inside and only ground and polished on the outside. This left a piece of glass weighing about 200 pounds, which must be silvered and handled in the different operations and carefully treated throughout so that it might be used over and over again. After several methods of experimenting were tried, involving continuous runs of 36 to 48 hours in many cases, and after the building of special tanks and equipment for handling, a process was finally developed at the Lynn Works whereby one mirror from each form could be turned out in finished condition every week.

Without going too far into details, the process employed is in general as follows: The glass is first placed on a movable table and carefully washed to remove every particle of foreign matter. The form is then placed on a silvering table and silvered by the ordinary mirror silvering process. When dry it is removed and secured on a special wheel-like supporting frame. The form and frame are handled as a single piece and placed in a silver plating solution where the silver is built up to a thickness of several ten thousandths of an inch. After rinsing the form is at once put into a copper-plating bath and copper is deposited on the silver until a thickness of about 0.030 inch is produced. Great care was necessary during this process to obtain a homogeneous copper of the greatest possible strength and toughness. The temperature of the bath, the strength and composition of the solution have to be carefully regulated through this stage of the process which requires from 30 to 40 hours. The arrangement of the anodes, the current density and the specific gravity of the solution are additional points that require close attention. After the requisite amount of copper is deposited, determined by the number of hours and the current density, the mirror is removed, washed and allowed to dry. When dry the

*From General Electric Review, Sept. 1919.

FIG. 1.—APPLYING THE CEMENT BACKING TO 60-IN. METAL MIRRORS AT THE LYNN WORKS OF THE GENERAL ELECTRIC COMPANY.

clips supporting the mirror are removed and the mirror placed on a table for backing, see Fig. 1. A coat of adhesive material is then applied to the surface of the copper and allowed to dry thoroughly. Then a backing in the form of a plastic coating is applied to a thickness of ½ inch and carefully smoothed and gaged on the edge to a uniform thickness, so that when mounted the axis of the mirror will be in the correct position. As soon as the backing is completely dry and hard, the mirror with back is removed from the glass and if necessary the silver surface cleaned. No polishing is required, as the silver comes from the glass with a high degree of polish, in fact, polished better than it would be possible to do with any ordinary polishing means. In order to protect the silver surface from atmospheric conditions it must be coated with lacquer, see Fig. 2. The lacquer is flowed on and allowed to dry in a dust-free room. The back of the mirror is then painted and the mirror stocked ready for shipment. In order to obtain a greater strength in the back it was thought advisable to use a sheet steel support in addition to the plastic compound. This was made up in sections and welded together giving a strong reinforcement having a weight of only 35 lb. This steel

FIG. 2.—THE LACQUERING OPERATION IN THE MANUFACTURE OF 60 IN. METAL MIRRORS.

was perforated with holes about ⅛ inch in diameter, allowing the plastic compound to come through and clinch all over the surface of the mirror back, see Fig. 3. This form withstands very much more abuse than any glass or ordinary mirror backing without injuring the surface, in fact this mirror seems to be so strong that

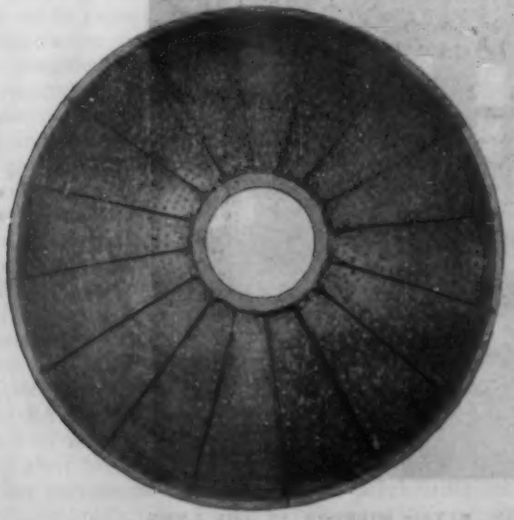


FIG. 3.—MIRROR WITH RIBBED SHEET STEEL BACKING.

it is now planned to mount the entire mirror and lamp from pivots attached to this steel backing of the mirror, thereby saving a large amount of weight.

The method of depositing silver and copper so as to produce a metallic layer that could be removed from the glass, the actual removing of the mirror from the glass and the handling of the heavy bulky piece throughout the processes were all problems to which much attention had to be paid, and many experiments were made before

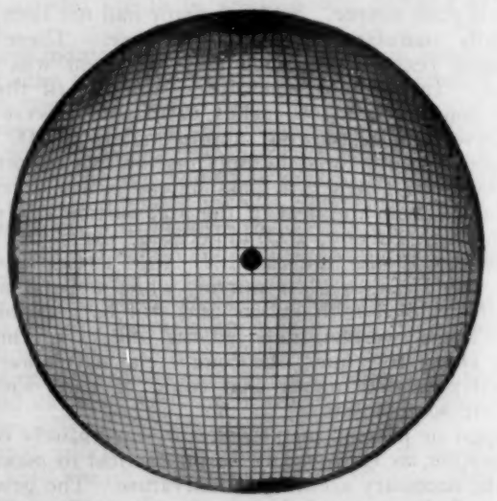


FIG. 4.—LINE PHOTOGRAPH ON 44-IN. METAL SEARCHLIGHT MIRROR.

a satisfactory process was finally reached. The plastic compound used for a backing material as well as the adhesive also demanded careful attention. The backing required to be strong, light, tough and without any shrinkage or expansion on setting. It was thought at one time that the copper should be deposited with a rough surface and the backing made to adhere to this rough copper. This could be done, but it was found that

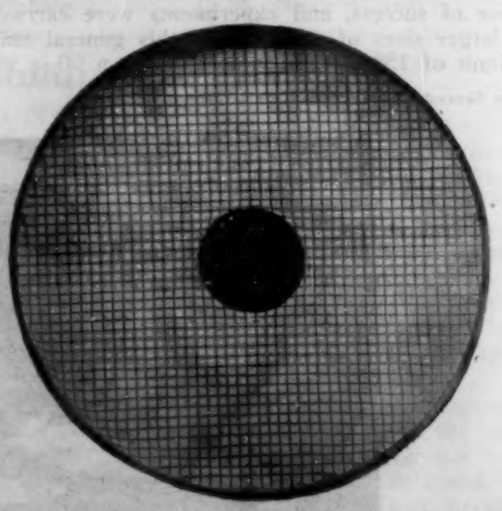


FIG. 5.—LINE PHOTOGRAPH ON 60-IN. METAL MIRROR.

the roughness tended to show on the surface of the silver mirror as very minute distortions of the curvature. Then, too, if the back is everywhere absolutely tight to the metal the unavoidable difference in thermal expansion between the two would either pull and distort the silver or crack the backing or both. Figs. 4 and 5 give some idea of the accuracy of curvature which has already

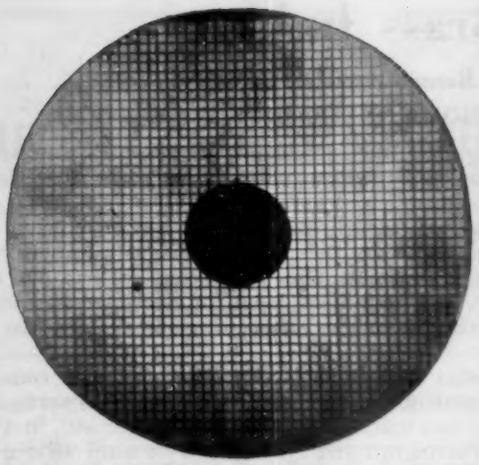


FIG. 6.—LINE PHOTOGRAPH ON 60-IN. GLASS MIRROR.

been attained in the manufacture of mirrors by this method. Fig. 6 shows a test on a good glass mirror.

Nickel Plating on Die-Castings*

By FRANK J. HANLON

A die-casting to be nickel plated, to the average plater means white metal and then comes his usual formula on the subject. If it works it is very easy, and if it does not work he immediately feels that the man who issued it was an experimenter and his results cannot be taken and used commercially; he then tries more formulas until he finds one that will work on the particular piece to be electro-plated; he then decides that this must be the proper method to plate die-castings and feels that with his experience and results obtained in use of this formula he has the best method.

The writer, who has had a great deal of experience on white metal and die-casting plating and also mixing of the alloys for same, in the process of manufacturing has come to the conclusion that the first thing to be done when die-casting is ordered for plating is to find out, if possible, the metals used in their alloy, for in his opinion therein lies the secret of successful plating of die-castings that one has to contend with in this era of speedy production. All manufacturers of die-casting now have come to the conclusion that the successful finishing of their product is what recommends it to the public, and the secrets of alloys are now public property that can be had from any metallurgist or any refining company interested in this business.

We have followed the business through the dark ages, when information was not so easily obtained, and had to spend a great deal of time in the foundry, in the pickling room, and in the public library, to obtain information that was not so liberally given those days as now. Thanks to the founders and members of our eminent society, workers in the art of electro-plating, we found that the great flux, used in foundries for expediting the even flowing of metals in brass casting was aluminum and this being transferred to the die-casting formula as an expedient to the running of their product or alloy has caused many a plater an aching heart.

During the war, when tin was a scarce product and very high priced, the metallurgist and chemist determined that lead could displace a certain amount of tin and become a part of the alloy, and then the standard method of plating die-casting was useless, and again we underwent another change with a lot of sleepless nights. Again our electro-plater assailed the die-casting company with having a poor product and they in turn branded Mr. Plater as a man without skill in his line; both were wrong; simply lack of co-operation between them. The writer in above does not wish to imply that his method is best, but wishes to advise that each company making die-castings should, for their own benefit, inform plater of metals in alloy used, so the plater can use his electro-chemical knowledge to best advantage and a credit to their product. Being at present in the job plating business specializing in die-casting plating, we come in contact with all kinds of so-called die-castings. Our first question determines the best solutions and the three different methods of preparing these formulas.

Die-castings that contain aluminum in quantities of 1 to 2 per cent and 1½ per cent tin and balance zinc and copper are polished and buffed, washed in weak alkaline electric cleaner and placed in solution of nickel containing 6 oz. sulphate nickel, 2 oz. sulphate magnesium, 2 oz. boric acid, using 2½ volts and mechanically agitated by rods moving about 18 to 20 movements to the minute; solution slightly acid.

For die-castings containing more aluminum up to 2 per cent and regular amounts of zinc, tin, and copper, with deep recesses, in addition to mechanical agitator we use air in perforated hose run through tank. This is plated in the same formula as first, but the solution is kept in a neutral condition.

Die-castings that are composed of lead bases are usually cleaned in gasoline, dried in sawdust, and again cleaned in a weak electric cleaner containing a small amount of copper to prevent lead oxide from forming on work prior to immersing in the plating solution. We use the same formula as on the other work, but keep solution in a neutral condition. (Read at Chicago Branch banquet, February 28, 1920.)

*The Monthly Review, March, 1920.

PLATING COSTS

Q.—We would greatly appreciate any assistance you can give us on the subject of plating, polishing, buffing and coloring and lacquering costs.

What we would like is the relation of the material cost (of the plating, polishing, etc., supplies) to the labor cost of each operation—showing nickel and copper plating separately.

What we have tried to do is to establish basic costs so as to take care of thin castings (under 1" thick) and sheet metal parts (from .014" to .090"), keeping in mind the area or surface finished.

A.—The cost problem covering polishing, plating and lacquering is a difficult one, as "labor" is the prime factor in each instance. It has been decided by many firms that if the labor cost is doubled it will cover the cost of materials and incidentals, but many firms add an additional 25 per cent for deterioration of equipment. We are of the opinion, however, that the problem can only be worked out as an individual proposition.

The equipment is a fixed charge plus the deterioration. The amount of supplies entering a department, and their cost, say, per month, should be kept in detail. The output in pounds of plated or lacquered material, or the number of pieces finished during a month, the labor cost of the month's production, etc. When those items have been tabulated, say, on a run of two or three months, then it can be readily determined whether doubling the labor cost of a month's production will take care of the cost of materials and incidentals expended in finishing. The percentage to be added to the cost of labor can then be made accordingly.—C. H. P.

Early Days of the Brass Industry

Reminiscences of a Brass Man Who Remembers Old Times

Written for the Metal Industry by THOMAS R. TAYLOR

THOMAS R. TAYLOR.

At the request of the publishers of THE METAL INDUSTRY, who know that I lived in Waterbury and have kept close tabs on the brass business for the past fifty years, I am writing my reminiscences of brass men and the brass business as I knew them.

I went to Waterbury as a boy at the close of the Civil War and landed there on the 29th day of September, 1866. I went to work first for Benedict, Merriman & Co., known as "the Brass Mills Store." This mercantile house was owned by the men who commenced and carried through the brass business in its early days, Deacon Aaron Benedict, Israel Holmes, Lyman W. Coe, James E. Elton, Calvin H. Carter, J. C. Booth, Hiram W. Hayden, F. J. Seymour, and Arad W. Walton. They were the prime movers in the place where I was first employed. Many came afterward whom I shall mention later.

At the time I went to Waterbury and commenced my duties as clerk, Deacon Aaron Benedict was the president, and Henry Merriman the manager. All the employees at Benedict and Burnham's, Holmes, Booth and Hayden's, Waterbury Brass Company, Scovill Manufacturing Company, and several other small concerns in different business but closely allied to the brass business were also in this country store.

After my first year with this concern I was the boy who had to inspect new men when they went to work in any of the shops, and find out how much pay they received, whether they were steady workers, and what their trade was. When I reported back to the store, they gave each man a pass book and credit for the month. At the end of the month, if they had been steady and had not traded too liberally they had the balance paid by our store in cash for the previous month.

This work gave me the opportunity to learn the brass business in a little more intelligent detail than was possible for many people, unless they were brass casters or brass rollers. My duties at this time brought me into close contact with the heads of the brass mills and with the workmen in the factory. I used to come into almost daily contact with Deacon Aaron Benedict and Deacon Charles Benedict, because they came to the store almost every day.

The store was really one of the first department stores, for we sold dry goods, groceries, clothing and everything that a family requires for their use. The goods were separated into different departments, and in mine were carpets, boots and shoes, and paper hangings. This was not active every day, so I had the opportunity to be out, and for this reason I became interested in the brass men.

The store was the headquarters for every manufacturer in Waterbury and they assembled there every night to talk over events. One of my first recollections is that one night in 1868, Deacon Woodard, superintendent of Benedict and Burnham, came in and said that Benedict and Burnham had that day made and shipped 500 pounds of brass rods, which for that time was an unusual quantity because brass rods were then a new proposition in the brass business. Up to that time we had had to use castings and turn them down for clock purposes and various other things for which we soon came to use brass rods.

Benedict and Burnham at that time was considered the biggest in the country, and all the brass made in this country was made in the state of Connecticut, in Waterbury, Torrington and Ansonia. Not until 1865 did the Bridgeport Brass Company start. It was first organized as a hoop skirt factory and finally was turned into a brass mill, which has become quite a factor in the brass world. At this time the principal men in Benedict and Burnham's factory, outside of the officers, was Alonzo Grannis, who had charge of the casting and all of the general detail of the mill. His brothers, Caleb and Norman, together with himself, were the only people supposed to know how to cast brass and for years they would not allow any one else to get on to the game. As time went by, however, others did find out how to cast the brass, and today it is an easy matter for anyone to learn the process. The three brothers just mentioned kept the secret well during their lifetimes and all died rich, though they never became owners nor had a brass mill in their own name, or under their own control.

About 1867 the new superintendent, George E. Somers, came to Benedict and Burnham from the Gorham Manufacturing Company and was the one who started the seamless brass tube business for this concern, after making several trips to Europe to gain information which contributed to his success with this class of material. Along in the early 70's this mill began to grow and various new people came to the front, but few of them have become known in the brass business anywhere else.

Mr. Somers remained as superintendent until 1881, when he and Col. F. A. Mason bought out the Bridgeport Brass Company and began to make that concern the success it is today. Somers was a mechanical man and worked at the bench for Wallace and Sons, then for Gorham, which fitted him for the new venture. Col. Mason was trained by John Davol and Sons, of Brooklyn, and was a salesman for them several years before he went to Benedict and Burnham, where he was the only salesman for many years. His capacity for work was enormous, and I have often heard him say that he could work for two mills that size and have plenty of time for recreation. He was known as a better brass man than anyone else in the business at that time. In fact, even today with all the up-to-date facilities there are few who can compete with him. C. F. Brooker came the nearest, but he did not pretend to be a general salesman. Today Mr. Brooker is the oldest brass man living. Mr. C. P. Goss, who died last year, and Mr. Brooker were the oldest survivors, but the former once told me that he was older than "Charlie."

Zinc roofs have been in vogue in Europe for centuries. Their durability and the fact that zinc is a non-rusting material are qualities responsible for Europeans adhering to this type of covering for both their homes and for public buildings.

EDITORIAL

Vol. 18 New York, May, 1920 No. 5

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, COPPER AND BRASS, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW
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NEEDLESS HOLIDAYS

The Merchants' Association of the City of New York, through its committee on commercial law, has opposed the enactment in the State of New York of the proposed additional holidays on Roosevelt's birthday (October 27), on Good Friday, and on Armistice Day (November 11), and we should say that the stand taken by the Association is in the name of common sense.

Like many of the other states the state of New York is already burdened with ten holidays, and in analyzing the list of these no-workdays, and investigating the reasons why we have such a number and their relation to industrial plants, we come to the following conclusions:

New Year's Day, the very day that everyone should start with their best effort in their year's work, is spent in loafing with no pretense of celebrating the day as originally intended, viz: the good old Dutch custom of calling on relatives and friends.

Lincoln's and Washington's birthdays, February 12 and 22. The shortest month in the year, the least number of workdays, has a loss of two days in honor of America's greatest two men, but could not the memory of their deeds be celebrated outside of working hours in as fitting a manner by patriotic observances in the schools, churches and town halls, rather than to stop all effort for a whole day?

Memorial Day, the 30th of May. All honor to our heroic dead in all wars and to the thoughtful custom of decorating their graves, but could not this honor be paid as well on the last Sunday in May as on a week day?

Fourth of July. Here we come to one of the days that should be a holiday, no matter what day of the week it comes. Our Independence Day should never be forgotten.

Labor Day. The first Monday of September. This is a class holiday and rightfully we should have no class holidays, but if labor must have a separate day under our present industrial conditions would it not be better for workman and employer to have that event fall on Saturday, the last workday of the week, instead of the first?

Columbus Day, October 12. Here is another holiday of recent establishment that could be dispensed with and scarcely be missed. With all due respect to the great achievement of Columbus, he never was a part of the history of the United States and why we should go outside of our own land to establish a holiday based on the accidental discovery of the American continent is like a mystery unexplained.

Election Day. "The first Tuesday after the first Monday in September." If everyone were given an opportunity to vote, which they should have, and which in our cities and towns does not take over an hour's time, would

that not be sufficient without wasting a whole day in the operation?

Thanksgiving Day. The last Thursday in November. The same reasoning applies to this holiday as to Memorial Day. Could we not give thanks on Sunday as well as on Thursday and would not the day be more fittingly observed than at present?

Christmas Day. The 25th of December. This day like the Fourth of July has become so fixed as a remembrance day in the minds of the people of the United States and of the world that this holiday is, of course, beyond retraction, and with the Fourth of July should, we believe, be observed as our two great national holidays.

The above holidays constitute our present list of no-work days which come at fixed and unfixed dates of the month, and various days of the week, and which compel the business man and the manufacturer who have obligations to customers and to the public to provide for the interruption and prostration of industry which they cause. To the wage workers holidays mean the loss of a day's pay, also a loss of production no matter how urgent may be the work required at the time of the holiday. This loss can be made up only by working overtime with its additional charges and its increase in the cost of living at present such a factor in our existence.

To those of us who work for salaries and suffer no loss in compensation, the holiday may come at a time when least desired, and with the crowded conditions in our cities when everyone at one time takes a day off the intermittent holiday does not give the salaried man the opportunity for relaxation and enjoyment that a holiday is supposed to provide.

As everyone should work so everyone should have recreation, but how much better for the community to have this recreation by taking individually a day off now and then when business is dull or in securing a longer vacation in July or August, the good old summer time, when most industries are having their dull period. The Saturday half-holiday is now quite universally observed and we have also Sunday, the day of faith, rest and recreation, besides shorter hours of labor, therefore, would it not be better for all industries and for the betterment of all the people to abolish a number of the needless holidays and put the time so recovered on longer vacations in the dull periods of business? Stop the handicap to production!

ELECTRIC FURNACE DATA

It is our belief that the most important and the most useful articles are those which contain the detailed records of work actually performed. It is not very often possible to obtain such material; for perfectly obvious reasons, investigators are shy about publishing the results. Generalities are plentiful, but actual figures are scarce.

In this connection we call attention to two very important articles in this issue. Electric Melting in an Oil Furnace, which contains the test on Comparative Data on the Detroit Electric, Schwartz and Coke Pit Furnaces, and Melting in a Detroit Electric Furnace. The detailed information in these articles justifies their reading by even the busiest of men. Also the article on Ajax Northrup furnace gives what we believe to be the most complete account published so far on the latest development in electric furnaces.

PRODUCTION OF ALUMINUM IN 1919

The value of the primary aluminum produced in the United States in 1919, according to reports received by the United States Geological Survey Department of the Interior, was $38,558,000, as compared with $41,159,000 in 1918. This decrease of $2,601,000 was probably due to a curtailment of production in 1919, forced by the accumulation of large stocks of aluminum by both the Government and the manufacturers in 1918. The market prices quoted during the first four months of the year were lower than those which prevailed during the remaining months, and apparently most if not all of the stocks were taken by the beginning of the last quarter.

PRODUCTION OF CADMIUM IN 1919

The output of metallic cadmium in 1919 was 99,939 pounds, compared to 127,164 pounds in 1918, and 207,408 pounds in 1917, the maximum output in the history of the industry. The production of cadmium sulphide was 31,197 pounds, compared to 51,702 pounds in 1918. The combined value of metallic cadmium and cadmium sulphide in 1919 was about $160,000, compared to $258,518 in 1918, and $376,036 in 1917. These figures, computed by C. E. Siebenthal, are made public by the United States Geological Survey, Department of the Interior.

Though prices of cadmium were somewhat lower in 1919 than in the three years immediately preceding, the industry closed the year in better condition than in 1918, for the reason that the consumption practically reached the level established in 1916-17, and this with the decreased production operated to reduce stocks of metal on hand.

PRODUCTION OF METALS IN MEXICO

Statistics showing the production of metals in Mexico from 1916 to September, 1919, have been published in Iniciativa de la Ley de Ingresos for the fiscal year of 1920. The following table, taken from the publication mentioned, gives the production for 1916, 1917, 1918 and 1919 (January to September), quantities being stated in kilos of 2.204 pounds each:

Metals.	1916. Kilos.	1917. Kilos.	1918. Kilos.	1919 (Jan-Sept.) Kilos.
Gold	11,748	23,543	25,313	17,208
Silver	926,142	1,306,988	1,944,542	1,462,255
Copper	28,411,248	50,985,923	70,223,454	38,170,209
Lead	19,970,986	64,124,752	98,837,154	50,533,765
Zinc	37,449,226	14,757,333	20,648,995	6,499,060
Antimony	828,767	2,646,544	3,268,546	470,778
Tin	292	9,214	13,537	1,588
Tungsten	12,250	187,637	149,486	21,969
Molybdenum	.....	.....	27,371	1,767
Manganese	.....	73,387	2,878,383	2,137,484
Mercury	.....	33,132	163,598	85,399
Arsenic	.....	1,284,820	1,881,011	1,641,250
Amorphous graphite.	470,343	420,046	6,190,849	3,758,714

ROUMANIAN OPPORTUNITIES

Roumania is a country abounding in undeveloped resources and would welcome with glad hands Americans and American capital to help her mine her metal wealth. Roumania has been partial to anything American since the American Red Cross fed, clothed and nursed her people. Twelve shiploads and nineteen trainloads of food, clothing and medicines distributed by workers under two flags—the Stars and Stripes and the Red Cross, helped to fight typhus and smallpox and finally stamped these dread diseases out. Roumania presents a splendid opportunity for American business men in almost every line—mining, engineering, exporting—Red Cross Magazine.

Bureau of Standards Circular, No. 80. Protective Metallic Coatings for the Rust-Proofing of Iron and Steel.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical. WILLIAM J. REARDON, Foundry. PETER W. BLAIR, Mechanical LOUIS J. KROM, Rolling Mill CHARLES H. PROCTOR, Plating-Chemical CORYDEN P. KARR, Exchange-Research.

BRASS PLATING

Q.—We would be grateful if you could give us some light on the following problem:

We have a brass solution composed of the following:

Sodium cyanide,
Copper carbonate,
Zinc carbonate,
Ammonia.

Current about twenty amperes, voltage five to six.

Very often we have difficulty in keeping up the current. The tanks start up well in the morning after standing all night, but the current gradually drops during the day. This is particularly the case after filling up the tanks when the solution has got low. The anodes appear to be coated with a greyish film, and the addition of ammonia or cyanide does not seem to have a lasting effect.

A.—From a distance we cannot say just what is wrong with your brass solution. You do not state the proportions of materials used in its makeup. However, we should judge it is deficient in free cyanide. A combined conducting and reducing salt will possibly help matters.

When this solution is in operation constantly it must be replenished from a stock solution at least once a day. Water does not build up a solution or replace what is taken out of solution during deposition. Water should be added only to take care of evaporation.

We suggest that one to two ounces of bisulphite of soda be added per gallon of solution, first. If deposition is slow afterwards add sodium cyanide to increase its action; from one to two ounces per gallon. If the deposit comes up a reddish tone, due to the greater reduction of copper, then add small amounts of sal ammoniac to bring up the zinc and brighten the color. Start with one-third ounce per gallon of solution.

When the solution is working correctly then prepare a brass stock solution based upon the following formula.

Add just so much of the stock solution every day by measure when the solution is in operation to maintain equal results. Add just so much water as is lost by evaporation.

Formula for stock solution:

Water 160 deg. Fahr	25	gallons
Sodium Cyanide 96.98%	25	pounds
Copper Cyanide	16	"
Zinc Cyanide	7½	"
Soda Ash 58%	5	"
Sal Ammoniac 98%	4	"

In preparing the solution use 50% of the water first to dissolve the cyanide, then add the copper and zinc cyanides. When dissolved add the balance of the 12½ gallons of water, next the soda ash and finally the sal ammoniac. Mix thoroughly and the stock solution is ready for use.

The only addition that should be required, if any, when the stock solution is used, is a little free sodium cyanide, but not more than one-quarter ounce per gallon should be added at one time.—C. H. P. Problem 2,816.

CASTING BRONZE

Q.—Will you kindly tell us whether or not it is practical to cast a mixture of 75 copper, 20 zinc, 3 lead and 2 tin into 15" or longer rods, about 1" diameter, by the use of an iron or steel mold having more than one cavity, and will you indicate how this mold should be made?

A.—It is possible to cast a mixture of 75 copper, 20 zinc, 3 lead and 2 tin into 15-inch rods, with a diameter of about 1 inch, by using an iron or steel mold. The method implied by the form of the question cannot be used. To group a number of molds together, so as to form one block of molds, so that they can be poured vertically, is not practicable for two reasons: 1st, in such a method of pouring the tin and lead of the composition would segregate out and settle to some extent at the bottom of the rod and form an inhomogeneous casting; 2nd, in pouring such a casting there would be great danger of cold sheets, and with such a large proportion of zinc the casting would be what is known among foundrymen as "spelter marked"—that is, dashes and markings of zinc oxide would deface and cut into the outer surface of the rod.

The proper way to cast such a rod is to have a steel mold made so as to cast the rod in a horizontal position, with a pouring gate about four inches high at one end, and a riser at the other end, four inches high. The pouring gate should have a diameter not less than the diameter of the rod; the riser opening in the steel or iron mold should be not less than three-quarters of an inch in diameter; the steel mold to be made in two parts, with dowel pins at each end to keep the two halves of the rod in true alignment. When closed the two halves of the mold are to be clamped together or secured by two heavy hoops made tight by steel wedges. The riser and the pouring gate should be located not less than one-half inch away from the ends of the rod.

In the course of repeated casting the steel mold will become discolored, oxidized and corroded by the fumes from the spelter, and the incrustations which accumulate must be removed from time to time in order to get acceptable castings. The surfaces of the mold should be well coated with lumbago, and before pouring the steel mold should be heated just too hot for the naked hand to withstand.—R. E. S. Problem 2,817.

POROUS CASTINGS

Q.—In making bushings and castings from scrap brass we experience considerable trouble on account of holes in the castings. As a rule, these holes and porous spots do not show up until we start machining.

A.—There are numerous reasons for holes and porous spots in brass castings, especially where scrap is used. It would be impossible for us to state definitely just what your trouble is without knowing more of your actual pouring conditions, or seeing a sample and a fracture of your castings. Blowholes may occur from any of the following reasons:

1.—Gas absorption during the melting.
2.—Oxidation during the melting.
3.—Pouring too cold or too hot.
4.—Improper gating and venting.

If you will send us details, such as the composition of your melt, the type of furnace used, the kind of fuel, where the castings are made, if sand or chill molds, and what sort of sand is used, and any other details which you think would be enlightening, we could give you much closer advice. A sample of one of your castings with a fracture would help a great deal.—A. B. Problem 2,818.

ETCHING

Q.—The writer wishes to have a trademark show upon an article which we manufacture. It is of cast iron, nickel plated.

It has been our practice, after the piece has been polished, to stamp the trademark on the polished surface in ink, and then nickel plate it. This has not proven satisfactory, as a great many of the pieces, after plating, show no sign of the trademark.

Do you know of any method by which this work can be done, either etching with acid, or is there such a thing as burning this in with an electric die? You no doubt have had problems similar to this and can give us some information, which will be greatly appreciated.

A.—In your city there is a firm that uses a similar method of etching trademarks or firm names upon products of their manu-

facture, i. e., nickel-plated advertising novelties, cigar lighters, etc.

They use a heavy black printers' ink, as a "stop off," and nickel plate as usual. They, however, use a double throw switch. The articles then become the anodes for a few minutes and the etching method is completed. Strange, however, the nickel is only etched beneath the ink. The balance of the nickel-plated surface seems to be untouched.

The writer has seen the method in operation many times when visiting Cincinnati. The rubber stamp method could be used by first coating the section to be etched with an ink and then use a strong solution of caustic soda applied to a regular ink pad. The stamp is pressed upon the pad and then to the ink. It removes the ink sufficiently to bare the iron or steel. The excess of caustic soda is sponged away with clean water and a mixture of strong nitric acid 1 part and water 2 to 3 parts is applied as an etching medium.

In this method many etchers prefer to coat the steel or iron with a thin coating of an alcoholic solution of Gum Ginacum. The caustic soda stamp method seems to leave clearer lines after etching than the ink does.—C. H. P. Problem 2,819.

CONTROL OF SOLUTION

Q.—Being a reader of your journal, I would like to make an inquiry as to what is the best, quickest and most efficient way of controlling plating solutions, such as brass, copper, galvanizing and nickel.

Also the best reference for a method to control the above solutions by chemical analysis.

A.—Efficient methods for the control of copper, brass, nickel and galvanizing solutions should be based as follows:

1st. Standard solutions with a metal content that will allow the maximum amperage per square foot of plated surface.

2nd. Highly concentrated stock replenishing solutions to replace loss under electrolysis and deterioration. This includes the solution that is carried out on the plated product.

3rd. Standard methods of electrical control. When the weight of metal per square foot of surface is standardized to give ample wearing surface; ampere meters; also ampere hour meters installed upon each tank so that the control can be as near the maximum of efficiency as possible.

As a reference work, covering the chemical analytic control of solutions as outlined, we would refer you to a most practical work by Price and Meade, The Technical Analysis of Brass.—C. H. P. Problem 2,820.

MELTING GOLD

Q.—Can you give the writer any information concerning the melting of alloyed gold in rather large quantities?

Our practice has been to make melts of only three hundred pennyweights to a pot but our requirements would justify out melting at least twenty-four hundred pennweights to a pot.

Our experience, however, has been rather disastrous when we have attempted these large melts owing to the sheet metal not being nearly as free from flaws as in the small melts. Do you know what the common practice is among large users of alloyed gold, such as the watch case manufacturers, manufacturers ot stock plated sheet and others who may use gold of fourteen and eighteen karat?

A.—For the best results in securing a homogeneous mixture of alloyed gold I should not advise making melts heavier than 6,000 ozs. Troy.

A number 80 crucible of standard make will hold this amount and allow ample room for stirring without risk of splashing. If it is essential to have melt absolutely homogeneous as top and bottom assays would determine, it is positively necessary to agitate the mass thoroughly. This mixing is conveniently performed with a graphite plunger, perforated, so as to have molten metal forced through holes as plunger descends, thus stirring all portions of melt. Heat graphite plunger in separate furnace to brilliant redness, before introducing in metal or small particles of gold will be rapidly ejected and ultimate loss increased. For a melt of this size 100 strokes on the stirring plunger is none too many.

A melt of this size should be ladled out of the crucible. A bar weighing as much as 200 ozs. can be safely poured with a No. 5 standard dipping cup. If it is desired to empty crucible at one pour, I should not advise lifting out crucible holding more than 1,000 ozs. Keep surface of melt well covered with powdered charcoal at all times, which can be held back or blown back through a tube, while pouring takes place, so as to prevent carbon entering the mold. Use clean molds, free from carbon deposits that may flake off and cause pitting on bars; and use only good lard or lard oil for greasing molds.

Gold melts are often made up to 8,000 ozs. or over, but the strain on the crucible is excessive and the risk of bursting pot too great to warrant taking the chance. Small melts of 100 ozs. can be made in convenient size crucibles and safely lifted out of furnace by pinching top edge with suitable pouring tongs. After which a better grip for pouring should be secured.—H. D. C. Problem 2,821.

PLATING SOLUTIONS

Q.—Having recently taken charge of a small plating establishment, I am asking you for some information about two solutions which are still here from the former plater, and which I fail to understand.

The first is of a light greenish color, or bluish, with grayish settlement on bottom. It is used to put a black color on chandelier work, slightly darker than would be done with butter of antimony on brass. Carbon anodes are used. While I use this solution, I have never heard anything of it before, nor does anyone else in the shop know anything about it, except what it was used for. Can you give me any information as to what it contains? The finish it produces is dull on unpolished surfaces, glossy on buffed surfaces, and stands a fine scratch brush, same as oxidizing on copper.

The second is a small cyanide solution, which seems to be silver, indeed copper wire placed into it takes on a deposit of silver. But steel anodes are used, and I have heard it said that the former plater used this solution to immerse steel knives before silver plating them. Can you tell me anything of this solution?

Also, there is a quantity of lump alum among the effects of the plating room. Can you tell me of any general use this is put to in the plating business?

About the silver solution: can you say what effect, ill or otherwise, it has upon the solution to leave the silver anodes in the bath when not using, as over night?—C. H. P. Problem 2,822.

A.—1st. We should infer that the solution is of the muriatic acid arsenic iron type. The solution can readily be replenished by adding a solution of muriatic acid and arsenic in concentrated form. It is advisable to heat the acid, as then the arsenic dissolves more readily.

A similar solution is prepared as follows:

Water, 1 gallon.
Caustic Soda, 6 ozs.
White Arsenic, 4 ozs.
Sodium Cyanide 96.98%, 1 oz.
Temp. normal.
Steel or Carbon Anodes.
2 to 4 volts.

2nd. This solution is evidently a silver strike solution used for the purpose noted to strike steel knives or nickel plated parts previous to silver plating. Its composition should approximate:

Water, 1 gallon.
Sodium Cyanide 96.98%, 6 ozs.
Silver Cyanide, ½ oz.
Caustic Potash or Soda, ¼ to ½ oz.

As noted, steel anodes or old steel files are used. A voltage of 3 to 6 may be used.

3rd. Lump alum is used as an addition agent to zinc sulphate solutions, copper sulphate solutions and also for the deposition of tin by simple immersion with tin chloride. (See formula in any authentic work on plating.)

4th. It is always advisable to remove silver anodes from the solution when the solution is not in operation. A slight excess of sodium cyanide has a reducing action upon the anodes, therefore the free cyanide is reduced when the solution is not working.—C. H. P. Problem 2,823.

PATENTS

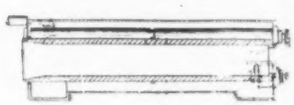
A REVIEW OF CURRENT PATENTS OF INTEREST

1,329,754. February 3, 1920. **Rotary-Casting.** Dimitri Sendsaud de Lavaud, of New York, N. Y.

This invention relates to rotary casting, and provides an improved method of casting metallic bodies and improved apparatus for carrying out such method, particularly having to do with the rotary mold and the supporting, driving, and fluid-cooling means therefor.

1,329,296. January 27, 1920. **Rotary Casting.** Dimitri Sensaud de Lavaud, of New York, N. Y.

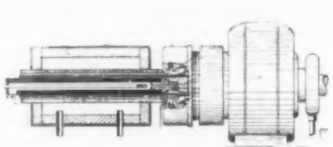
This invention relates to rotary casting, and provides an improved method of casting metallic bodies in a non-laminated rotary mold. The object of the invention is to avoid the necessity of using either or both the more or less complicated arrangements disclosed in a copending U. S. application, Serials Nos. 194,976 and 194,977, while nevertheless water-cooling the mold and supporting the same for rotation to prevent any possibility of the mold jamming in its journaling bearings during rotation or warping longitudinally or otherwise becoming injured as the result of uneven heat expansions following the deposit therein of a charge of molten metal to cast an article or articles of the annular type in the mold by the rotary casting method.



1,329,455. February 3, 1920. **Method and Apparatus for Drawing Metal.** Louis H. Brinkman, of Glen Ridge, N. J., assignor to Ball Rolled Tube Corporation, a corporation of New York.

This invention relates to the drawing of metal rods or tubes.

It is one object of the invention to shield the metal to be drawn from becoming excessively heated.

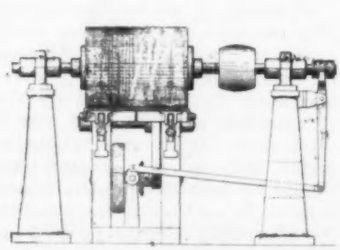


It is a further object of the invention to evenly distribute the heating of the metal.

It is a further object of the invention to prevent the formation of scale.

1,329,551. February 3, 1920. **Buffing-Machine.** Louis Schulte, of Pittsburgh, Pa., assignor to E. I. duPont de Nemours and Company, of Wilmington, Delaware, a corporation of Delaware.

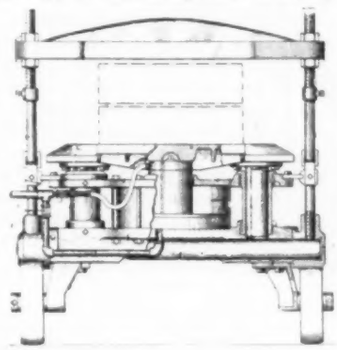
This invention has for an object to provide a machine for performing buffing or similar operations in which the work is so supported as to secure uniform pressure of the same against the buffer, and in which vibrations of the machine will be taken up or absorbed without detriment to the same.



Another object of this invention is to provide a machine which can be easily set up on a floor although the floor be uneven, and in which a proper adjustment of the work supporting table may be readily made.

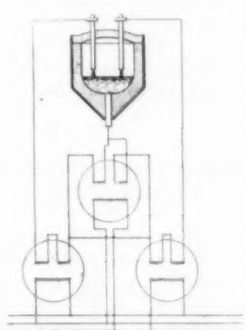
Another object of the invention is to provide a work table driving means which will operate without special adjustments in all positions of the table.

1,327,419. January 6, 1920. **Molding-Machine.** Allan S. Bixby, of Indianapolis, Indiana, assignor to the National Malleable Castings Company, of Cleveland, Ohio, a corporation of Ohio.



This invention relates to power molding machines, and consists in a slidably mounted table for the molds, so actuated that it will pack the molding material in the mold while the mold is being filled, and after the mold has been filled will squeeze the mold and thereby compress the molding material therein. This invention also consists in mechanism whereby various sizes of pressure cylinders may be used merely by changing the case and contained parts, but without changing the cylinder heads.

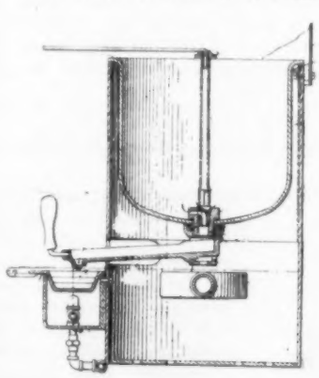
1,327,174. January 6, 1920. **Three-Phase Electric Furnace.** Frederick T. Snyder, of Oak Park, Illinois, assignor to Industrial Electric Furnace Company, of Chicago, Illinois, a corporation of Indiana.



The object of the present invention is to provide an improved method and means whereby three phase supply current may be applied to an electric furnace having only two carbon electrodes and a bottom contact. In carrying out this invention, therefore, it is possible not only to dispense with the third carbon electrode constituting an item of additional expense, but it is possible to use three standard transformers, all of which are alike, thereby effecting a further economy.

1,328,236. January 13, 1920. **Metal-Melting Furnace.** Garnet W. McKee, of Rockford, Illinois.

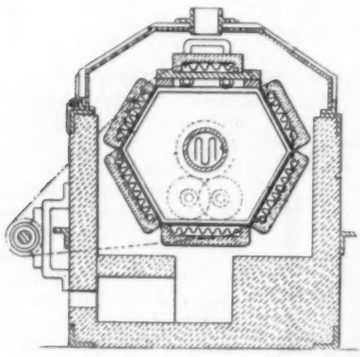
This invention relates to furnaces adapted for melting soft metals to be poured, and has more particular reference to the melting of linotype metal and the pouring thereof into molds to cast pigs suitable for use in melting pots of linotype machines.



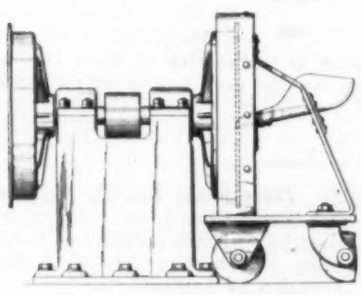
In furtherance of this aim, the invention contemplates various objects, certain of which will now be briefly mentioned. One object is to provide for heating the melting pot in a most efficient manner and for properly housing the pot so as to convey away the gases resulting from the gas flames. Another object is to provide a construction by which the metal may be quickly and easily poured successively into a plurality of molds, the flow of metal being very accurately controlled by simple manipulation of a movable spigot and a valve controlling member.

1,327,102. January 6, 1920. **Sherardizing Apparatus.** Charles J. Kirk, of New Castle, Pennsylvania.

This invention relates to sherardizing apparatus. As is well known the process of sherardizing consists essentially in applying to metallic surfaces pulverulent zinc partially oxidized and subjecting the same to heat in a closed chamber. The present invention relates to the retort or closed chamber within which the process takes place and has special reference to increasing the heating efficiency whereby the time required for effecting the sherardizing may be greatly reduced.

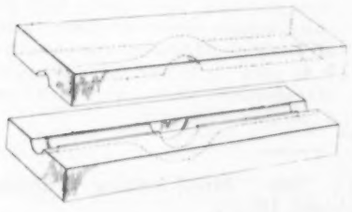


1,329,179. January 27, 1920. **Centrifugal Valve-Casting Machine.** Frederick Hilty, of Waukegan, Illinois, assignor to Laurence R. Wilder, of Chicago, Illinois.



This invention relates to a centrifugal casting machine, and more specifically is concerned with the provision of a machine whereby to cast puppet valves of the type commonly employed in connection with internal combustion engines.

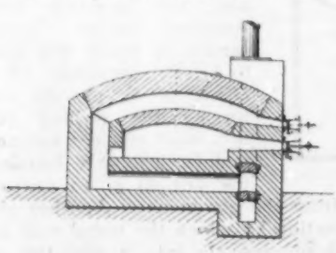
1,329,135. January 27, 1920. **Method of Electric Welding.** Thomas E. Murray, Jr., and Joseph B. Murray, of Brooklyn, New York.



The present invention is a method of producing by electric welding the object aforesaid, wherein said welds are made simultaneously and in an infinitesimal period of time, and herein is illustrated as such object, a housing for the transmission gear of automobiles, in which, when made in two longitudinal half sections, as hereinafter set forth, it is of obvious importance that neither of the welded joints on opposite sides of the middle opening should be less strong than the other.

1,329,873. February 3, 1920. **Annealing Furnace.** Ludwig Wolfgram, of Erie, Pa.

The object of this invention is to provide improvements in annealing furnaces for the purpose chiefly of insuring a proper heating of the furnace, and preventing excessive wear thereof, and particularly breakages such as occur frequently with annealing furnaces of the constructions now employed. One of the features of this invention resides in the possibility of employing ordinary firebrick in the construction of the furnace, so that the structure is relatively strong and much less liable to breakage, cracking and other accidents than the existing furnaces of this class.



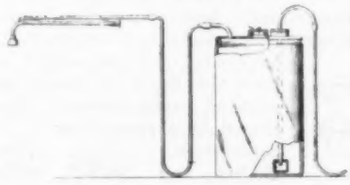
1,327,401. January 6, 1920. **Process of Surface-Coloring Articles of Copper Alloy.** Thurston C. Merriman of New Haven, Conn., assignor to Winchester Repeating Arms Co., of New Haven, Conn., a corporation.

This invention relates to an improved process of coloring metallic articles, the object being to impart a durable and handsome finish of black, or substantially black, color, to alloys of copper containing arsenic.

With these ends in view, this invention consists in a process of coloring articles made of alloys containing copper and arsenic, which consists in first dipping the articles in an acid oxidizing bath and then in an acid solution containing a sulfid and an arsenious compound.

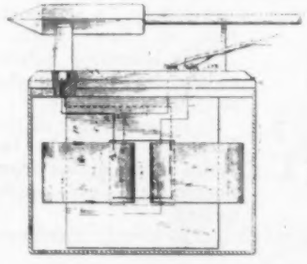
1,329,270. January 27, 1920. **Soldering and Melting Apparatus.** Perfecto M. Elias and Felix F. Llera, of Tucson, Arizona.

The general object of the present invention is the provision of a soldering and melting apparatus of blowpipe type, designed more particularly for jewelers' use, and constructed in such manner that it is unnecessary for the operator to pay any attention to the connection between the gasoline receptacle and the source of compressed air supply.



In the practical use of this novel apparatus it is simply necessary for the operator to manipulate a single valve in order to regulate the flame afforded.

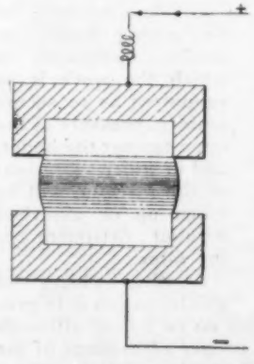
1,330,712. February 10, 1920. **Electric Heater for Soldering Irons.** William A. Lanahan, of Memphis, Tennessee.



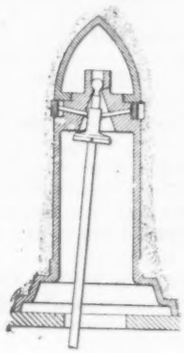
This invention relates to electric heaters and more particularly to a means for heating soldering irons for welding wires or brazing together small articles, and has for its object to provide a device in which various sizes of soldering irons may be conveniently heated without adjustment. Another object is to construct a device of a form which can be conveniently carried about from place to place.

1,329,136. January 27, 1920. **Method of Electrical Welding.** Thomas E. Murray, Jr., and Joseph B. Murray of Brooklyn, N. Y.

Two bodies to be electrically welded are commonly held in electrodes which are moved relatively to one another during the passage of the welding current. The portions of the bodies which protrude into the space between the electrodes are thus rendered plastic by the current and are also compressed and extruded. It is often desirable that the take-up of metal due to this compression should be definitely predetermined, because in such case, for example, the electrodes themselves need not come into contact at the end of the operation, and so be liable to burning. Again, it may be important that the reduced dimension of the bodies pressed together and in the direction of the pressure after the weld is completed should be some precise figure.



1,328,582. January 20, 1920. **Means for Forming Recesses on Sand Molds.** Abram C. Mott, Jr., and Lewis Kinsley, of Philadelphia, Penn., assignors to Abram Cox Stove Company, of Philadelphia, Pa., a corporation of Pennsylvania.

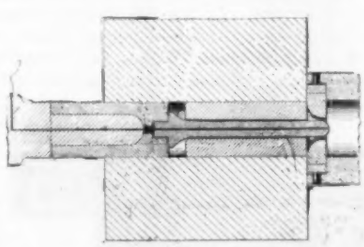


One object of this invention is to improve the construction of patterns used in making shells and other articles where a recess is formed in the walls of a mold cavity.

A further object of the invention is to design the mechanism of the pattern so that a single ring, or segment of a ring, or slides, can be projected into the sand of the mold after the sand has been rammed.

A still further object of the invention is to provide a templet for controlling the movement of the means for projecting the segments when it is desired to make recesses at given points.

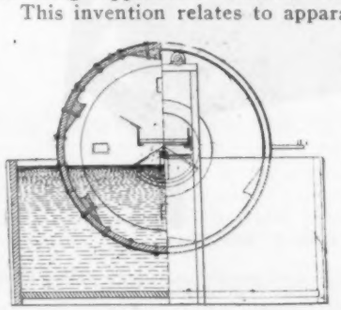
1,331,169. February 17, 1920. **Machinery for Extruding Metal Tubes.** Herbert D. Swift and Abraham Lincoln Scott, of Yonkers, New York, assignors to the Swift-Scott Corporation, a corporation of New York.



The invention relates to machinery for extruding metal tubes, particularly non-ferrous tubes. The object is to provide an apparatus having a high rate of output and producing tubing the bore of which is truly concentric to the outer circumference, and further to facilitate withdrawal of the ram from the tube and stump, the removal of the stump from the mandrel, and the insertion of a fresh billet, at the conclusion of the extrusion operation, and at the same time to enable the apparatus to be quickly and readily changed over from one size of bore to another, or the mandrel to be replaced or repaired. The object is also to provide advantageous means for cooling the mandrel, the same means making possible the connection and disconnection of the mandrel unit, which is rigidly carried by the ram in action. In addition to the above, it is an object to make the invention applicable to existing rod extrusion presses.

1,326,891. December 30, 1920. **Electroplating and Electrocleaning Apparatus.** Andrew Ness, of Glasgow, Scotland.

This invention relates to apparatus for electroplating and electroplating of the kind having a rotary drum wherein the articles are retained when the drum is rotated in one direction and are automatically ejected when the drum is rotated in the reverse direction.



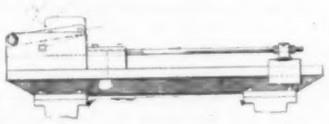
An apparatus made in accordance with this invention comprises a rotary drum provided at one end with a concentric aperture and provided internally with means adapted, when the drum is rotated in the one direction to lift articles placed therein and deliver them on to a tray introduced through the said aperture.

1,331,376. February 17, 1920. **Oil-Burner.** William Raymond Quinn, of Spokane, Washington.

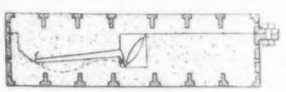
Now it is the primary object of this invention, both as a method and as a mechanism, to break up, disintegrate and disperse the oil just prior to the atomizing action of the steam thereon so that when the steam begins to act, the oil will be sufficiently broken up so that the steam will be initially acting with the greatest efficiency in atomizing the oil. Therefore this invention includes an abutment against which the oil is initially directed prior to engagement of the oil with the steam. This improved abutment not only functions to break up the oil but it is so shaped, in the preferred construction, as to spread the oil after the latter has been broken up, and in this connection, it is also a feature of this invention in at least one embodiment, to change the direction of flow of the oil after the latter has been broken up and spread.

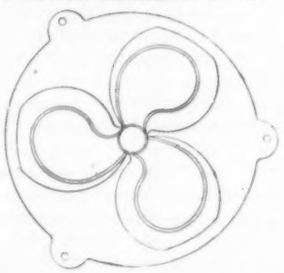
1,327,641. January 13, 1920. **Machine for Forming Metal Tubes.** Frank H. Stolp, of Geneva, New York.

The present invention relates to metal working machinery and it has for its object to provide a simple, efficient and conveniently operable machine for forming strips or blanks of sheet metal into tubular or tubelike structures involving the creasing or bending of opposite lateral edges of the blank with relation to its central portion. The invention contemplates the provision of an improved apparatus for shaping into tube form a sheet metal blank and interlocking the edges of this tube in a tight joint of the character, for instance, known in the art as a lock seam.



1,330,660. February 10, 1920. **Method and Apparatus for Casting Propeller Wheels.** Thomas Oxenbridge Thatcher, of Albany, New York, assignor to Thatcher Propeller and Foundry Corporation, of Albany, New York, a corporation of New York.



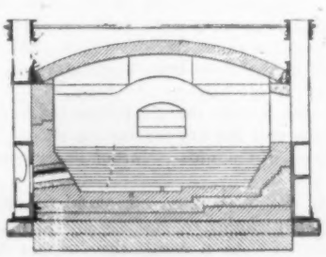


This invention relates to method and apparatus for casting propeller wheels, and blades, which has for its object to provide a propeller in which the blades, whether cast separately or as an integral propeller wheel, will be so accurate in their position, pitch and dimensions as to require little or no finishing to secure a wheel which is balanced and symmetrical.

A further object of the invention is to provide a method and apparatus of casting propeller wheels and blades by means of which accurate blades or propellers may be made in any quantity from the same set of patterns without requiring greater skill on the part of the foundryman than possessed by the ordinary labor employed for the purpose.

1,330,052. February 10, 1920. **Furnace-Roof Construction.** Charles E. Bonsor, of Lorain, Ohio.

This invention relates to the construction of the transversely arched roofs of melting, heating, annealing and similar furnaces, and more particularly relates to the construction of the skewback supports and the refractory skewbacks used in carrying and transmitting the thrust of such arched roofs to the side walls and metal framework of such furnaces.



EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

A NEW SERVICE

A new and, for the metal field, unique service has been organized by Holz & Company, 17 Madison Avenue, New York City. It consists of a resident purchasing department for firms which have their headquarters out of New York City. Believing that a large part of the source of supplies for the foundries, casting shops and plating shops is in the East, they have organized a department under a man who was, for some time, purchasing agent for a large manufacturing concern. The charges for this service will be based entirely on the amount of business executed. The advantages claimed are the following:

1. Close touch daily with the market, which enables the purchaser to take advantage of any fluctuations of price.
2. The fact that, as purchasing agents for many concerns in similar lines, they are enabled to obtain a bulk price on individual orders.
3. A saving in cost of operating the department.
4. Information and data are kept on file which would take the time of an important official, and considerable expense for an individual to gather.

The idea of a resident purchasing agency is not a new one. It is simply the application of a scheme, which has been proved successful in other fields, to the metal industries. Holz & Company believe that a real need can be filled by a reputable concern in this way.

A NEW PORTABLE FURNACE

A high, sustained temperature, generated in a short period of time with the strictest economy of operation are the principles upon which the design of the furnace of the Champion Kerosene-Burner Company, of Kenton, Ohio, is claimed to be based. This heating unit, entirely self-contained, is used for heating rivets, heat-treating tools, "shrinking-on" processes and similar operations calling for an intense heat in a small, portable hearth.

The secret of this quick flame lies in the fact that the kerosene is reduced to a gas just the moment before it is ignited. The effect is the same as that secured by the vaporizing jet in the carburetor of an internal combustion engine.

A long series of experiments have shown that the flame gives a range of heat of from 2,500 to 3,000 degrees Fahrenheit. The flame is not an oxidizing agent.

The self-contained feature of this new furnace is also noteworthy. A fuel storage tank is carried on the lower platform of the stand. These tanks are of various sizes, depending upon the use to which the furnace is to be put. For the general run of work one filling of the reservoir is sufficient to operate the furnace, with feed valve wide open, for a 10-hour day. For this reason no pipe connections need be installed at different points in the shop or field. With the flame still going the furnace can be lifted by a crane and deposited on another part of the job right next to the work which is waiting for it.

Compressed air, at a pressure of from 80 to 90 pounds, forces the fuel from the storage tank to the burner, which is located just above the hearth. This air is forced into the tank by means of an ordinary automobile pump. A pressure gauge on the top of the tank shows the amount of air remaining inside at all times.

In spite of the fact that fuel is constantly being drawn out of the tank, with a consequent lowering of the fluid level and enlargement of the air space, experiments have shown that the original air pressure still remains adequate to feed the burner properly. Only in exceptional cases does the air supply have to be given extra attention, after it has once been taken care of in the morning.

By the simple opening of a few valves the air forces the kerosene from the storage tank, through the copper tubing shown in the illustration, into the burner. No pumps or other extraneous accessories are needed.

The tank, placed as it is at the bottom of the stand, is easy to fill. There are no complicated pumps to run, or an intricate system of valves to take care of. As a result the furnace can be operated by an unskilled man. The rapidity with which the furnace may be heated, obviates the necessity of the operator reporting 20 or 30 minutes ahead of time in order to get his furnace ready for work.

Another feature of the All-In-One furnace claimed, is its conservation of fuel. Tests extending over more than a year's time show that the kerosene consumption, even with the furnace operating at full blast, will not exceed more than three-quarters of a gallon per hour. In a 10-hour shift the furnace would only require, 7½ gallons. At a wholesale price of 14c. a gallon the daily cost of fuel amounts to only $1.05.

The non-oxidation feature permits of leaving the work in the furnace for an indefinite period without danger of its burning up. For this reason work can be heated, cooled and reheated time after time without any diminution in size.

The high temperature to which the furnace can be raised results in a thorough "cooking" of the work. This is especially noticeable in riveting operations. Under the hammer the All-In-One treated rivets flow into every part of the hole. This obviates the slow, expensive work of cutting them out after they have cooled and replacing them by hand.

In the ordinary crude oil furnace the number of rivets which can be heated at one time is limited. In the All-In-One furnace the number is unlimited. If necessary, a whole keg of rivets can be dumped into the hearth and preheated. Rivets for immediate use can be placed directly under the flame of the burner, while

ALL-IN-ONE FURNACE.

the others, already in a semi-heated condition, can be raked in as needed.

Nearly a year ago the Champion Engineering Company installed a battery of these furnaces. In that time by the aid of these furnaces their production of fabricated steel girders was increased 35 per cent.

The Champion Kerosene-Burner Company is turning out these furnaces in various sizes, provided with one or more burners depending upon the type of work for which they are intended. They have recently produced a tool tempering furnace, claimed by its users to temper tools that will resist from 25 to 30 per cent. more wear than those tempered under ordinary conditions.

A NEW HARDNESS TESTER

It is claimed that the Rockwell Hardness Tester, manufactured by S. P. Rockwell, 122 Dickerson St., Syracuse, N. Y., is particularly adapted to small intricate shapes. The Union Twist Drill Company are using one of these machines and are testing the hardness of their drills right up to the cutting edge and on the land. In the factory of the manufacturers, they claim to have been able to make considerable saving on broaches, finding that in a shipment of a number of broaches they will discover a number that will stand up excellently and give great service while others will chip. In testing these they have found sufficient difference in hardness to warrant the ones that would chip to be drawn. The Diamond Chain & Manufacturing Company of Indianapolis are using this machine to test their chain link work including the small tubing, etc. For use on springs this machine is also recommended as accurate and true readings are given.

The Driver-Harris Company recently sent in some samples of Monel metal and German silver to test (two pieces of each)

ROCKWELL HARDNESS TESTER.

one of which had been cold drawn and the other cold drawn and annealed. It is claimed this machine showed very accurately the difference in hardness between the two and required less time in taking the test than the Ericson method. The machine is furnished with four chucks, two flat, of different heights and two V chucks of different heights. Inasmuch as these chucks are easily removed, chucks of a special design can be readily made up and slipped in their place by the user himself to meet his own particular demands. The points are made of a special alloy steel and two in number are furnished with the equipment. With ordinary use these points should last around ten thousand readings, but if they should give out before that time it takes but a matter of five or ten minutes to lap them back into proper shape.

About the most difficult thing to do is to get a piece of metal uniformly hard. On wrist pin work the manufacturers claim to have been able to detect very accurately soft areas and to plot them out. Although adapted to small, intricate parts, large pieces up to 2½ inches in diameter can be tested. For the bar mill, however, no great saving is claimed inasmuch as the work and the question of time is not so important.

The testing points furnished with the machine are standardized and each machine is calibrated so that one may talk in Rockwell units of the machine for comparative work. Should it be desired to compute in Brinell, it is a very simple matter to Brinell a number of standard pieces, being sure that they are uniformly hard and then test them with the Rockwell Testing machine and draw the Brinell-Rockwell curve. One must of course consider that alloy steels will not give the same curve as straight carbon steels, any more than Brinell and Scleroscope curves may be compared for all different kinds of steel. For separating large quantities of work the main thing is to know whether the work comes in the required limits or not. It is only necessary to establish the limits by any method of testing which one now uses. Working tests of course are the best. Take for instance one has a piece that is too hard, another piece that is too soft and a piece that is just right; one can very quickly find the allowable limits on the Rockwell tester and establish these limits for the benefit of the operator.

In operating this machine initial pressure is first applied, which amounts approximately to fifty pounds; this tends to seat firmly the specimen under test and to break through light scale and decarburization on the piece. The final pressure is applied by the hand lever and it is this pressure that makes the test point sink into the metal and the depth of the impression is read direct on the indicator. The indicating dial is divided into one-fifth of a thousandth and can be read at one tenth of a thousandth inch. The final pressure is variable at will to meet the condition. On extremely soft metals it is often found best to set the final weight at 200 pounds so as not to get too deep an impression on the work and possibly not permit the indentation to be ground out, providing of course the piece is ground later. For the ordinary steel work the final weight set at 300 gives the best results.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

ELECTROPLATERS' SOCIETY CONVENTION

The Rochester Branch of the American Electro Platers' Society plans to make this year's convention, which will be held in their city at the Seneca Hotel, June 30, July 1, 2 and 3, the most notable and interesting convention in the history of the society.

The various committees are very active in putting thru the arrangement so that no stone may be left unturned to make this convention complete in every detail.

The Program Committee plans to publish the program in a very attractive form. Nearly all the manufacturers who advertised last year are co-operating with the committee and renewing their space. Many new concerns will be represented. Any concern that wishes to be represented should reserve their space early. Harry Bernard, of 115 Roslyn Street, Rochester, N. Y., is chairman of the Program Committee and attending to all the advertising.

One large advertiser who has a full page in the program every year said, "We consider this space among the best advertising that we do. It is in a class with THE METAL INDUSTRY and reaches just the people that we wish to put our advertisement before."

Emphasis is being laid in the convention's arrangements on the educational program that will be of unusual interest. The list of speakers will be announced shortly. Many progressive manufacturers have already indicated that they intend to have their superintendents and their platers attend this convention—just for what they will learn. An attractive recreational program is being planned. Rochester has much to offer in this line. The major entertainments will be announced before the convention assembles, but surprises will be held in reserve for every day.

The Rochester hotels are already making reservations for rooms and it is a wise move to make sure where you will sleep, by sending in your hotel reservations now. A list of the hotels with prices follow:

A. E. S. Headquarters—Hotel Seneca

Hotel Seneca Room Rates	1 person per day	2 persons per day
Rooms with running hot & cold water	$2.50	$3.50
Rooms with large bed & shower bath	2.75	4.00
Rooms with large bed & shower bath	3.00	4.50
Rooms with large bed & tub bath	$3.00 to 4.00	4.50 to 6.00
Rooms with twin beds & shower bath		5.00
Rooms with twin beds & tub bath		7.00
Hotel Powers Room Rates		
Rooms with running hot & cold water	$2.00	$3.00
Rooms with shower bath	$2.50 to 3.50	3.50 to 6.00
Rooms with tub bath	2.75 to 4.00	4.00 to 7.00
Hotel Rochester Room Rates		
Rooms with shower bath	$3.00	$5.00
Rooms with tub bath	$3.50 to 4.00	6.00
Hotel Hayward Room Rates		
Rooms with running water	$2.00 to 2.50	3.50
Rooms with bath	$2.50 to 3.00	3.50 to 4.00
Whitcomb House Room Rates		
Rooms	$2.00 to 3.00	$3.00 to 4.00
Rooms with bath		4.00 to 5.00
Hotel Eggleston Room Rates		
Rooms	$1.50	$2.50
Rooms with bath	2.00	3.50

NEW YORK BRANCH

March meetings of the New York Branch were well attended. President Sterling presided. Five applications for active membership were received and referred to the Board of Trustees.

The main topics under discussion were Brass, Bronze, Galvano, and Platinum Hydrate Solutions.

April meetings were well attended, President Sterling presided. Four applicants were elected to membership, one associate and three active. Under miscellaneous discussions the following subjects were discussed: "Chemical Coloring of Galvano-Plastic Articles," "The Value of the Armeter in the Plating Room," "Silvering Mirrors for the Optical Trade." Laboratory Chairman Mr. Haas gave a very interesting and instructive talk on the generation of the electric current and its consumption in the electrolyte.

On account of over a 100 per cent. rental advancement demanded for our present laboratory and meeting room, New York branch of the A. E. R. wishes to announce to its members that the regular 2nd and 4th Fridays' meetings will be held at the parlors of the Broadway Central Hotel, Broadway and Seventh street, New York, N. Y. The Tuesday nights' laboratory sessions will be held at the Stuyvesant Trade School, 16th street near First avenue, New York, N. Y.

PITTSBURGH BRANCH

The first anniversary banquet of the Pittsburgh Branch of the American Electro-Platers' Society held April 19, 1920, was a complete social and financial success.

Although the Baby Branch has only 31 members, there were 54 at the banquet table on the above occasion. The banqueters were addressed by Robert Garland, one of Pittsburgh's Councilmen, and Norval Daugherty, an attorney of Pittsburgh; S. E. Hedden, secretary of Pittsburgh Branch, and Richard Slyter, of the Cleveland Branch, second national president. The fourth speaker was Arthur H. Roberts, of Pittsburgh.

The Publicity and Program Committee made a big success with the program, the advertisers being the Hanson & Van Winkle Company, Boissier Electric Company, G. J. Nikolas & Company, Celluloid Zapon Company, Jantz & Leist Electric Company, J. B. Ford Company and Natrolin. The banquet has resulted already in a number of applications being turned into the branch, and there are more in sight.

CHAMBER OF COMMERCE CONVENTION

The metal industries of the country showed considerable interest in the great gathering of business men from all parts of the country held at Atlantic City, April 27 to 29, under the auspices of the United States Chamber of Commerce, for the purpose of making a comprehensive study of means to stimulate production in industry.

Men prominent in each of these respective lines of industry and commerce presented their views to the convention. The banker explained the need of extending a helping hand to Europe in order that Europe might become once more a producer rather than a consumer. For more than four years Europe has been depending largely upon the United States for its commodities. The demand has been greater than our industries could meet. The result has been advanced prices. If European industries could be put back on their feet again by supplying them with raw materials and credit then the strain would be partially relieved, and American industries would be able to supply more goods to meet the domestic demand.

Among the representatives of the metal industry the following attended the conference:

Pressed Metal Association—R. P. Dryer, Cleveland, Ohio; Douglas P. Coah, Worcester, Mass.

American Zinc Institute—Charles T. Orr, Webb City, Mo.

National Association of Brass Manufacturers—Adolph Mueller, Decatur, Ill.; W. M. Webster, Chicago, Ill.

Metal Finishers' Equipment Association—Floyd T. Taylor, New York, N. Y.; B. H. Divine, Utica, N. Y.

JOINT ENGINEERING CONFERENCE

The Joint Conference Committee of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers has issued a call to the engineering organizations of the United States for an Organizing Conference to be held at Washington, D. C., June 3 and 4, 1920.

This action is taken pursuant to the following resolution unanimously passed January 23, 1920, at a joint meeting of the governing boards of the above-named societies and of the American Society for Testing Materials, which constitute the member-societies of Engineering Council, also of the Trustees of United Engineering Society and Members of Engineering Council,

"Whereas, this conference of national engineering societies has considered the recommendations of the Joint Conference Committee of the Four Founder Societies, therefore, be it

"Resolved, that the conference adopts in principle that report and requests the Joint Conference Committee to call, without delay, a conference of representatives of national, local, State and regional engineering organizations to bring into existence the comprehensive organization proposed."

Purpose.—Co-operation of engineering and allied technical organizations to further the public welfare wherever technical knowledge and engineering training are involved and to consider matters of common concern to these professions.

Further information can be obtained from L. C. Marburg, secretary, 29 West Thirty-ninth street, New York City.

FOREIGN TRADE CONVENTION

One of the important features of the Seventh National Foreign Trade Convention, to be held at San Francisco, Cal., May 15-20, 1920, will be the world conference of American foreign traders, according to preliminary announcements just mailed to American firms represented at previous conventions, who are requested to have their representatives, living or traveling abroad, time their visits to this country so as to take advantage of the valuable opportunities afforded by this Convention.

Information regarding steamer routes, days of sailing and the Program of the 1920 Convention, is being furnished by O. K. Davis, Secretary, National Foreign Trade Council, No. 1 Hanover Square, New York.

NATIONAL SAFETY COUNCIL

The Spring Conference of the Engineering Section of the National Safety Council (headquarters, 168 North Michigan avenue, Chicago), was held at the Engineering Societies' Building in New York City, April 27.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

W. M. Corse, formerly chairman of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, has been elected a Director of the latter Institute.

Charles F. Lederer, until recently Superintendent of Way of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has become associated with the Rail Welding Department of the Metal & Thermit Corporation, New York.

H. J. Richards has severed his connection with the Koken Manufacturing Company of St. Louis, Mo., and has accepted a position as salesman with the St. Louis Platers Supply Company.

H. J. RICHARDS.

Mr. Richards has been a foreman electroplater in St. Louis for 27 years, having been successively with the Art Metal Construction Company, the Ludlow-Saylor Wire Company and the Koken Manufacturing Company. He is well known to most platers through his connection with the Monthly Review of the American Electroplaters' Society, of which he was the editor for four years.

Donald Payne, who formerly conducted investigation work for the production manager of Aluminum Manufactures, Inc., Cleveland, O., is now advertising manager for the Osborn Manufacturing Company, Cleveland, O.

At a special meeting of the Board of Directors of the Hilo Varnish Corporation **John H. Mills,** dean of the sales organization at Hilo, was elected a vice-president of the company.

Arthur L. Walker, professor of metallurgy, Columbia University, is delivering a course of lectures on non-ferrous metallurgy, before classes of the new engineering school at Harvard University. The first lecture was delivered in February and the course will continue until about June 1. Prof. Walker is continuing his regular work at the School of Mines, Columbia, but is giving the lectures at Harvard on Thursday of each week.

Thomas Stanion, director of safety and sanitation for the Aluminum Castings Company, Cleveland, Ohio, gave the first of a series of ten-minute talks on "Shop Housekeeping and Safety First," before the Industrial Association of Cleveland, Hotel Olmstead, February 24. He also gave a talk at the annual banquet of the Safety and Sanitation Committee of the Cleveland Metal Products Company on April 9, on "The Safety Committeeman's Job."

Alexander Harper, of Bristol, Conn., was recently elected president of the American Silver Company. He started as a bank clerk, but left to go with the American Silver Company. He worked in the factory for a year, on the selling force, had charge of the Chicago Branch, and as Assistant General Manager until his last promotion, when he was made president and treasurer.

Jules Vedrines, the famous French aviator, met his death a year ago in trying to accomplish his first voyage by aeroplane from Paris to Rome. The unfortunate champion of the air left an old mother (aged 71), a widow and four children (aged 5, 7, 8 and 10), and it is for their help that a committee has been founded which is patronized by members of the French Government in order to provide for the needs of the family and to erect a monument in the place for which the celebrated Jules Vedrines started for his tragic flight.

The headquarters of the committee for the subscription to the monument of Jules Vedrines, is situated at 93 Boulevard Beaumarchais, Paris. The subscriptions (mandate or cheque) are to be addressed to the treasurer, Monsieur Georges Labastie, 7 Place de la Bastille (Paris IV), France.

Dr. Van. H. Manning, Director of the Bureau of Mines, Department of the Interior, tendered his resignation, effective June 1, to President Wilson. Dr. Manning is leaving the Government service to accept the position as Director of Research with the recently organized American Petroleum Institute, the most important body of petroleum men of the country.

The nomination of **Dr. Frederick G. Cottrell** for director of the Bureau of Mines, Department of the Interior, was sent to the Senate by President Wilson, to take the place of Dr. Van H. Manning, resigned. Dr. Cottrell was the assistant director of the Bureau under Dr. Manning.

Dr. Cottrell is a member of the American Chemical Society, Mining and Metallurgical Society of America, the American Electrochemical Society and the American Institute of Mining and Metallurgical Engineers. He was awarded the Perkin medal by the New York Section of the Society of Chemical Industry in 1919 in recognition of his work on electrical precipitation. He is best known as the inventor of the Cottrell Process for precipitating fume and fine particles suspended in the gases of smelter, blast furnace and cement works flues.

DEATHS

GEORGE W. OAKLEY

George W. Oakley, 67, head of the Oakley Chemical Company, of New York City, died April 22, 1920, at his home, 315 Carlton Ave., Brooklyn, N. Y. He had been suffering from influenza several weeks, and due to his age, was unable to overcome the illness.

He was associated with D. C. Ball and D. C. Smith in the formation of the Oakley Chemical Company in the latter part of 1908, and was actively connected with the company up to the time of his illness.

LESTER C. STRONG

Lester C. Strong, 59, vice president, treasurer and secretary of the Strong Manufacturing Company, died April 23, 1920, at the Massachusetts General Hospital, Boston, following an operation. He was one of the leading manufacturers of Winsted and was well known throughout the state. He was a former warden of Winsted, former member of the state legislature, a trustee of the Gilbert School and Gilbert Home, a director of the Litchfield County Hospital, former president of the Winsted Club and was associated with other activities.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

MAY 3, 1920.

That out-of-town agitators are at the bottom of the strike of approximately 7,000 unskilled laborers in the brass manufacturing plants here seems to be the opinion of both manufacturers and local labor union officials.

"Not a single man has been discharged because he is a union man" (the chief cause of grievance given), said John H. Goss, general superintendent of the Scovill Manufacturing Company. "The men simply dropped their tools and walked out before presenting their demands. This strike is the result of outside agitation."

"The New England Workers' Association did not want the strike," said Luigi Scalmana, president of the Association. "Outsiders came into our meeting and by stampeding it succeeded in swinging the members of the association toward their viewpoint. They practically forced our men to support those who had gone on strike a week before by misrepresenting the facts regarding the situation."

The strike, which has been in progress since the middle of April, has been carried on very quietly and has been orderly, with no hint of a repetition of the strike riots in Waterbury last June. Facts of the strike would seem to bear out the statements of the factory official and labor union president regarding outside agitators. The first group to walk out scarcely numbered more than 100. They walked out without presenting any demands. Other unskilled workers went out gradually until now the total number out is over 7,000.

The situation here is peculiar in that the strikers themselves are organized into two unions, the Waterbury Workers' Association, a purely local union formed after the strike last June, and into chapters of the A. F. L. Throughout the strike efforts have been made to secure an amalgamation of the two, but to no avail.

The situation today is a complete deadlock between the manufacturers and the strikers. It is expected that representatives of the United States Department of Labor will come to settle the strike.

The chief bone of contention, as in the strike last June, is the recognition of the union. Waterbury manufacturers as a whole are unalterably opposed to the union.

The demands as sent to the manufacturers are:

1. The right to organize and bargain collectively by the employees through representatives of their own choosing.

2. Forty-four hours to constitute a week's work, as follows: Monday, Tuesday, Wednesday, Thursday and Friday, 8 a. m. to 12 m.; 1 p. m. to 5 p. m.; Saturday, 8 a. m. to 12 m. All overtime to be work only in case of emergency and for which time and one-half shall be paid.

3. Proper protection of health of the employees shall be provided by the employers.

4. There shall be established a minimum rate of wages of 75 cents an hour.

The increased cost of rent and all living expenses is given by the strikers as the reason for their demands for higher wages. They declare that it is impossible to preserve a decent living standard under present conditions. Their payment, ranging from 45 cents to 65 cents an hour, they claim is wholly unadequate to support a family in any degree of comfort. The long hours they say are an especial hardship. Waterbury is one of the few cities in the country which has not outgrown the ten-hour day. After ten hours of hard manual labor, they say, they are too exhausted for even light amusement, not to mention attendance at night schools and Americanization classes.

John H. Goss, of the Scovill Manufacturing Company, on the contrary, says:

"Personally I feel that the wages the men get at present are more than enough to take care of the increase in commodities due to the high cost of living. The situation cannot be compared to that of last year. We realized that a raise was necessary at that time and we gave them 45 cents an hour plus the equivalent of an hour's pay. This brought their daily earnings up to $4.95, as they are being paid for 11 hours, although they are actually working only 10 hours. In addition to that they get time and a half for overtime.

"The unskilled laborers received, by and large, about three times as much as in 1914. Their daily wage in 1914 ranged from $1.50 to $1.65 a day for 10 hours. Compare this with the present scale of $4.95 a day. Many of the men receive more than 54 cents an hour.

"It is not true that we have discharged men because they belonged to unions. We have an open shop. But we have strict rules that any man who agitates in working hours will be dismissed. That is simply a matter of efficiency, as he is taking his own and the other man's time.

"The strike will affect us tremendously. Half of the plant is out. We're like a ship in a storm under present conditions, but we'll reach port." Officials of the American Brass Company and the Chase Companies take an almost identical view of the situation.

The local organization of skilled machinists considered support of the strike but as yet have taken no action.

The chief difference between the demands of the Waterbury Workers' Association and the local branch of the A. F. L. lies in union recognition. The former will stick for recognition of shop committees as against recognition of the union principle demanded by the latter.

About 2,000 men are out from the Waterbury Brass Branch of the American Brass Company, 50 per cent of the Benedict and Burnham Branch, 50 per cent of the Chase plants, and, according to last reports, 2,000 from Scovill.

The journeymen electricians of Waterbury have accepted a compromise with the master electricians of a minimum rate of 87½ cents an hour until October 1, when a new rate of $1 an hour will go into effect. The recent railroad strike played havoc with Waterbury manufacturers. It was impossible to ship goods out for two or three weeks.

Waterbury factory workers are being interested in buying shares in the new Building and Loan Association. Payments are made in installments. It is rumored that employees of the Scovill Manufacturing Company are to have a community co-operative store. D. H. P.

BRIDGEPORT, CONN.

MAY 10, 1920.

The seventh annual banquet of the Bridgeport Branch of the American Electro Platers' Society will be held at the Stratfield Hotel, Saturday, May 29, at 7 o'clock in the evening. The banquet committee are trying to make this a very enjoyable event, as the ladies are invited and a fine musical program has been arranged.

There will be two or three short addresses following the dinner. One will be by Miss Zelia Jencks, of Chicago, a very well-known member of the society. Miss Jencks came into prominence in electro-plating work at the Bureau of Standards, Washington, D. C., in assisting the development of the flueo-borate-lead plating solution. She is now pursuing electro-chemical research work at Yale University.

Musical selections and dancing will follow the banquet.

In the afternoon there will be an open business meeting in the ballroom of the Stratfield, where papers will be read on various plating problems. Discussion will follow. The committee has arranged with Dr. Blum, of the Bureau of Standards, to give his illustrated lecture showing the various chemical and electrical manipulations which influence the character and quality of electro deposits. This will be the first time that the lecture has been given in this State.

There will be a display of all kinds of metal goods, in all plates and finishes, to interest the visitors following the afternoon session.

J. M. Dunn, of the Holmes & Edwards Silver Company, is president of the association and Royal F. Clark is secretary-treasurer.

The Stanley Rule & Level Company of New Britain has bought the factory at 936 Crescent avenue, now operated by that concern. The factory here is in charge of Charles E. Zink.

The situation affecting industries throughout the eastern part of the country was summarized by William R. Webster, of the Bridgeport Brass Company, when he said, "There is a world of uncertainty in the industrial situation, and one cannot see what developments there will be. The recent railroad strikes affect not only our materials and the shipments of our finished products, but also our coal. Thus far we have had to make no plans for closing, however, because we are fortunate in having a supply of coal on hand, and our raw materials stock is also abundant enough to keep us busy for the present. We hope to get over the stringency without diminishing our operations, and we will make no plans for closing until we are compelled to."

Another large industry is to be added to Bridgeport's varied array with the start of the Liberty Machine Company to manufacture the four cylinder Cameron air cooled internal expansion engine. The new company is incorporated in this State and is capitalized for $250,000 and has plans drawn for a factory which will house 2,000 employes.

The Columbia Graphophone Company discharged 1,200 employes last week on account of its inability to procure raw materials with which to manufacture its products.

HARTFORD, CONN.

MAY 10, 1920.

Through an amendment to the building code which is in operation in this city, it is believed that the different industrial developments will be benefited. Dissatisfaction over the provisions of the code which stipulate that there can be no maximum fee, a certain amount being added for each $1,000 worth of construction, resulted in the appointment by the board of aldermen of a special code revision committee, which submitted its recommendations to the common council this week.

The chief change suggested was that a maximum building fee of $5,000 be provided. The recommendation was adopted, and the new fee system will go into effect next week. That this will mean a big saving to the industries, although it will mean a loss to the municipality is evident. The Hartford Rubber Works, for instance, has plans in the works for new buildings, fees on which would amount to between $20,000 and $25,000. Under the new ruling, the maximum fee which may be charged for this work is $5,000.

Manufacturers and builders have expressed themselves as pleased with the change, which has been suggested since the inception of the code, on April 1, 1919.

The J. R. Montgomery Company, of Windsor Locks, is planning to erect an addition of six stories to its factory, at an estimated cost of $350,000. It will be of brick construction.

Thomas J. Kelley, manager of the Manufacturers' Association of Hartford County, in a statement issued recently, declared that, unless there was a change in the bituminous coal situation, he would take the matter up in headquarters, as the coke supply of many local factories is pretty low. As far as power is concerned, however, it is believed that the Hartford industries are safe.—W. A. L.

NEW BRITAIN, CONN.

MAY 10, 1920.

With the manufacturers and laborers of the neighboring city of Waterbury engaged in a final grapple for supremacy, New Britain this spring is strangely free from any disrupting labor controversies. If there is any undercurrent of discontent, it is evidently being smoothed out before it assumes any dangerous proportions. This, together with the prosperous condition of the plants and the large amount of business on hand augurs well for the coming months.

The recent merger of the Stanley Works and the Stanley Rule & Level Company, one of the biggest of its kind in the country, has been closely followed by action of the Traut & Hine Manufacturing Company in increasing its capital stock from $500,000 to a million, and, in addition, giving a 100 per cent stock dividend. A few days later the stockholders and directors of the Hart & Cooley Manufacturing Company increased its capital stock from $600,000 to a million dollars.

The New Britain Machine Company, formerly one of the largest machine and tool making establishments in this section, and during the war managed almost entirely as a government ordnance plant, is again on a peace-time schedule and is trying to increase its output. Beginning with May 3, the factory will operate both a day and night shift to speed up production. A statement given out at the factory says that "the working force is to be materially increased on account of the volume of business." Large production on the "New Britain" tractor is to begin at once. At the present writing the machine company is making preparations to install the tractor assembly department in the government anti-aircraft gun department, a building 100 by 341 feet, with a balcony which gives space of 46,000 square feet.

The American Hardware Corporation is plugging along in its effort to maintain a standard production of builders' hardware, and the same is true at the Stanley Rule & Level and Stanley Works plants. The North & Judd Manufacturing Company is also working at top speed. Landers, Frary & Clark have recently added to their already large line of household utensils, a vacuum cleaner which is said to be a winner. This is now being put on the market. This same concern, which already had under construction a large addition to its aluminum shop, has ordered all work on that addition halted and no more work will be done this year on the addition. This is because of the high prices demanded by all of the men in the building business. However, another large addition, taking in most of a city block, on East Main street, is being rapidly pushed ahead to completion. Another factory addition of moment is at the American Hardware Corporation, where a massive brass foundry is nearing completion and will be ready for use within a few weeks.

In addition to the large concerns about the city doing such a thriving business, all of the smaller concerns, employing but a few hands, are now experiencing a rush of business. These little concerns are mostly all tool-making plants and receive considerable business as the overflow from the big corporations.

Employees of the William L. Gilbert Clock Company, of Winsted, who went on strike April 12 for ten hours' pay for nine hours' work, returned to work after being out about a week. The company employs about 600 hands. When the committee presented its demands, C. E. Williams, general manager of the plant, refused to grant them. He said that the effects would be "to increase cost of and decrease production, increase overhead and indirect expense, force an increase of the sales price of products and yet cause wages to remain stationary." He said that carrying forward the analysis the change would absorb the margin between cost and selling, as the cost would be increased; fewer orders would come, cancellation of orders on hand would probably be made, and there would be less buying by the consumer. He also said that the absorption point for clocks appeared to have been reached. German goods are coming in, competitors are quoting lower prices, and if the Gilbert company had to increase prices there would be fewer orders from wholesalers. In concluding his reply, Mr. Williams said:

"The organization—you and I—have greater responsibilities than ever. Unless these responsibilities are performed efficiently and faithfully so that progress can and will continue, disaster will ultimately fall upon us. Therefore, as all payments of every kind must come from the output, and restricted output means restricted funds, there is only one course to pursue, and that is the plant will continue to operate without change of hours and under the same consideration of each individual as heretofore."

The employees of the Winsted plant of the Fitzgerald Manufacturing Company also went on strike during the past month, but only a small proportion of the total force was involved and the strike was unsuccessful. There was no trouble at the Torrington plant of the company.

The daylight saving schedule went into effect in Winsted on May 2—a week behind the other towns in this section.
—H. R. J.

TORRINGTON, CONN.

MAY 10, 1920.

Contracts were awarded during the past month for two additions to the Excelsior Needle plant of the Torrington Company. One building is to be two stories high, 27 x 42 feet, of brick construction with iron roof, and will cost approximately $7,000. It will be attached to the south end of the hardening shop. The other building will be one story high, 25 x 49, of brick construction with tar and gravel roof, and will cost approximately $6,000. It will be attached to the north end of the plating building.

The voters of the town at a special town meeting on April 21 voted down an appropriation of $70,000 for a trade school building in Torrington. A previous meeting had appropriated $40,000, but this was found to be insufficient and the bigger appropriation was asked.

Mr. and Mrs. Clive B. Vincent have returned from a trip to England. Mr. Vincent went there in the interests of the Torrington Company.

John J. Cassidy has resigned as superintendent of the Trumbull Vanderpoel Company, of Bantam, and will go to Massachusetts.

Daylight saving went into effect in all Torrington factories Monday morning, April 26.

Employees of the Coe Brass Branch of the American Brass Company have contributed $1,505.95 to the Gaylord Farm Sanatorium, and Charles F. Brooker has duplicated this amount, thereby creating a total fund of $3,011.90, to be known as the American Brass Company, Coe, Torrington, Employees' Fund, the income to be used at the discretion of the directors of the sanatorium. Nearly 2,000 employees contributed.

Henry G. Ellis, of the Torrington Manufacturing Company, has been elected chairman of the Torrington executive committee on Americanization work.

A ball was held on the evening of April 9 in the new addition to the plant of the Torrington Manufacturing Company. There were 400 guests, including employees of the company and officials of other concerns. The grand march was led by Mr. and Mrs. James F. Dewey, Mr. Dewey being in charge of the miscellaneous department which is to occupy the new building. Henry G. Ellis, superintendent of the plant, and Mrs. Ellis were next in line. The new building is two stories high, 180 x 60 feet, of concrete, flat slab type of construction and thoroughly fireproof. It borders on Treat street, south of the other buildings of the company. Brass novelties and other miscellaneous metal articles will be made there and the older buildings will be used exclusively for the manufacture of machinery, etc.

The factory baseball league opened its season May 1. Plants represented by teams are: Standard, American Brass, Hendey Machine, Union Hardware, Turner & Seymour, Excelsior Needle, Union Hardware, Progressive Manufacturing, and Torrington Manufacturing.

The Fitzgerald Manufacturing Company has just placed on the market two new products—an electric dish washer and a massage shower spray. Both of these products, it is expected, will attain a popularity equaling that attained by the electric vibrator, of which the company is now turning out nearly 3,000 per day. The entire Winsted branch, employing close to 250 hands, is being devoted to the manufacture of these vibrators. The two new products will be manufactured at the big new Torrington plant of the company.

James H. Graham, general factory manager for the Torrington Company, underwent an operation for appendicitis at the Charlotte Hungerford Hospital on April 24. He passed through the ordeal satisfactorily and is well on the road to recovery.—J. H. T.

PROVIDENCE, R. I.

MAY 10, 1920.

There is said to be little change in the business situation of the manufacturing establishments throughout the State engaged in the various lines of the metal industries. The majority of these plants are still being rushed with work and have plenty of orders ahead. This is especially true as regards all the branches allied with the manufacture of jewelry and metal novelties.

As though the problem of securing enough help that has been the bane of the manufacturers for several months was not sufficient handicap, many manufacturers in different sections of Rhode Island are confronted by labor unrest that threatens to become actively opposed to business interests at any moment.

Nor is the shortage of help the only contingency brought about through the unsettled labor conditions. Railroad strikes with the consequent tieups, embargoes and congestion of freight by rail and similar discouraging conditions by water routes leaves the manufacturers between the devil and the deep sea, for he can secure transportation for neither supplies nor production.

The manufacturing jewelers continue to experience the rush conditions that have prevailed for more than a year. This, however, is having a stabilizing effect upon general conditions in the industry. Heretofore the jewelry business has been considered as a seasonable one in which there were about five fat months, four lean and the rest of the year loafing time. But since the outbreak of the world war conditions have gradually changed to such a degree that the jewelry manufacturing plants are now being operated on the year-round plan. This is beneficial to workmen, manufacturers, dealers and the general public, and it is believed that having established the fact that the jewelry business can be conducted on a year-round basis there will be no return to old conditions.

Announcement was made from the offices of the Gorham Manufacturing Company in this city of the annual meetings of The Silversmiths' Company, which is the holding corporation, and of The Gorham Company, the selling corporation of the Gorham Manufacturing Company. At the meeting of The Silversmiths' Company the following officers were elected: President, John S. Holbrook, of Providence; vice-president, Harry A. Macfarland, of Mount Vernon, N. Y.; secretary, William S. Stone, of Providence; treasurer and assistant secretary, Arthur G. Folsom, of New York. Directors: John S. Holbrook, Herbert J. Wells, Russell Grinnell, Henry S. Sprague, Frank W. Matteson, Robert L. Knight, Alfred K. Potter, William A. Viall and James S. Utley, all of Providence; Samuel D. McChesney, of Newark, N. Y.; Daniel Saniford, of Boston; Arthur G. Folsom, of New York; Harry A. Macfarland, of Mount Vernon, N. Y.; George E. Wells, of Bridgeport, Conn., and George Carleton Comstock, of New York.

The annual meeting of The Gorham Company, of New York, resulted in the election of the following officers: President, John S. Holbrook, of Providence; vice-presidents, Alfred K. Potter, of Providence, and Robert Loch, of New York; secretary, William S. Stone, of Providence; treasurer, James S. Utley, of Providence. Directors: John S. Holbrook, Alfred K. Potter, Frank W. Matteson, Russell Grinnell and James S. Utley, of Providence; Robert Loch, of New York, and Harry A. Macfarland, of Mount Vernon, N. Y.—W. H. M.

ROCHESTER, N. Y.

MAY 10, 1920.

The month just ending has been one of considerable anxiety to large users of metals and manufacturers in general. The railroad strikes, embargoes and what not have served to greatly retard the output and curtail production as well. Every industry of any importance whatever is well supplied with orders, and could be operated at top speed could raw materials, a requisite amount of help and improved shipping facilities be obtained.

The industries requiring quantities of brass, copper and sheet steel are greatly handicapped at this time, owing to the inability to obtain stocks and the strike at the Waterbury brass mills. The situation as regards aluminum and tin is almost as bad, although it is possible to get tin in larger amounts than the other materials. It is reported that much trading or borrowing has been indulged in of late. In any event reserve stock has been heavily drawn on in Rochester during the past month.

Much regret has been expressed because of the lack of improvement in shipping facilities. Neither freight nor express routes have given local manufacturers any relief. The recent strikes have set back the outgo of finished goods to a large extent. Metal materials en route from the east have reached city in much better time than similar shipments from western points. It is expected that the coming months will tend to improve conditions.

The labor situation is none too reassuring. There is a scarcity of skilled help in all the big plants, which acts as a handicap in many directions.

Owing to the strike in the building trades many additions to manufacturing plants about the city have not been started. A big new building to be added to the Eastman Kodak plant was to have been constructed at once. Its erection is now deferred until Fall, at least, and maybe until another year.

The several committees having in charge the matter of the coming convention of the American Electro-Platers' Society meet each Saturday evening at Hotel Seneca, where the sessions of the convention are to be held at the end of June. Much progress has been made in perfecting the arrangements, and everything points to a most successful and interesting convention.—G. B. E.

DETROIT, MICH.

MAY 10, 1920.

Detroit manufacturers in the copper, brass and aluminum field have passed through some very trying experiences within the last month, and although conditions seem to be clearing, there still is much to cause anxiety as to what the future will bring forth. The railroad strike, with the accompanying inconveniences and losses, are causing manufacturers to wonder if the bottom is going to drop out of everything.

A large proportion of manufacturers here are supplied by electricity, for both lighting and power, by one big corporation, and when the coal supply was shut off as the result of the strike, all were forced to suspend. Thousands of persons were thrown out of work, and it was more than a week before it was possible to get enough coal through to start the plants going again. But even then it was only on a 40 per cent. basis and it stands about that today. There are very few plants in the city that are operating at full capacity, with the exception of the Ford Motor Company, the Burroughs Adding Machine Company, and a few others, which are able to produce their own electric power. But shipping facilities are so crippled even today that the automobile companies are sending thousands and thousands of machines overland at a great additional expense. Thousands of others are stored and will not be moved entirely until the railroads are able to handle them. There is one gratifying fact, however, navigation is just opening up and steamship lines out of Detroit will relieve the situation quite a bit. But coal and empty freight cars Detroit must have if her plants are to resume their normal amount of production.

Manufacturers, in general, do not seem to be so worried about price conditions of raw material, etc., as one might think when he hears so much about what is expected to happen to food and some other products. Detroit's problems just at present relate to coal, freight cars, transportation facilities, help, and places in which to live. If these were solved manufacturers here would have a much easier time than has been their lot for many months.—F. J. H.

PHILADELPHIA, PA.

MAY 10, 1920.

The railroad strikes and consequent tieups of freight have, of course, been the chief concern of the local metal industries recently. Delays in deliveries of material and fuel have caused considerable restriction of operation in a number of plants, but very few, if any, were entirely closed as a direct result of the strike. The majority of plants had enough fuel on hand to maintain at least partial operation. Had the strike continued much longer the industries of the entire city would have been seriously handicapped. The Philadelphia Electric Company, which supplies many plants with power, was getting near the end of its coal supply, and plans were under consideration for allotment of power to the more essential industries and operation of municipal works and public utilities when the situation cased. Freight is now moving into the city in good volume, and although receipts of materials are not back to their normal amounts, virtually every industry is able to operate.

Because of the mounting of prices in all kinds of machinery the volume of sales on new work is feeling a slackening effect. Builders of machine tools especially report some restriction of business. On the other hand the dealers in second-hand tools are benefitting by the high prices and slow deliveries on new tools. There is, however, no lack of work on hand in any of the metal shops, and many of them have orders booked for months ahead. The fact that prosperity is expected for many months to come is attested by the many new plants and extensions to old metal working plants which are under way here.

The Wicaco Screw & Machine Works, Inc., Seventh and Wood streets, are preparing to build a one-story machine shop 82 x 157 feet to cost about $80,000, including equipment. A three-story office building will also be erected in the near future.

A large share of the $50,000,000 new bond issue just arranged for by the Pennsylvania Railroad will be used for extensions and improvements to shops and mechanical equipment. Among the works planned are new repair shops at Marietta, Pa., to cost about $2,000,000.

The Fox Motor Car Company is preparing plans for a three-story plant on a property near Tabor station on the Philadelphia & Reading. The first unit will be a re-enforced concrete building 80 x 400 feet. The company will manufacture motor car parts.

The C. R. Carver Company, Twentieth and Clearfield streets, manufacturers of lead cutters, has filed plans for a one-story addition, 42 x 50 feet.

The Haverford Cycle Company has increased its capital stock from $350,000 to $500,000.

The Brown Instrument Company is erecting two new buildings at a cost of $100,000. One will be used for the manufacture of recording thermometers and the other as a research department.

The Franklin Brass Foundry Company has increased its capital from $10,000 to $50,000. Work will soon be started on doubling the capacity of the foundry and tripling the machine shop capacity.

Albert Goldman, for a number of years with the Philadelphia office of S. Birkenstein & Son, has opened an office under his own name at 407 Finance Building, and will conduct a brokerage business in new and scrap metals.

Damage estimated at $175,000 was done by fire several weeks ago at the plant of the Philadelphia Roll & Machine Company, Twenty-third street and Washington avenue. The pattern shop and pattern storage house were destroyed.

Nine men were injured recently by the explosion of a large coil of pipe which was being dipped in a bath of molten zinc at the plant of the Empire Galvanizing Company, 2507 East Cumberland street.—G. B. G.

CINCINNATI, OHIO

MAY 10, 1920.

The outlaw strike of switchmen has placed havoc with the metal industry, the same as it has hampered all other lines of industry. Materials, already scarce, because of various adverse circumstances affecting the trade, have become scarcer because of the strike and production in this vicinity as a result has been curtailed. However, the strike situation in this district is righting itself rapidly and it is hoped that it will be greatly relieved before the month of May has passed.

Increased wages to workmen naturally have kept the finished product on the upward trend, and there is little likelihood of a stabilized market for some months at least or until conditions right themselves more equally than they are at present. A twenty per cent increase has been granted to workers in the large stove factories in the Cincinnati district, the same increase having been given to metal polishers in these plants in all parts of the country. Their pay now is 95½ cents an hour, 318 workmen in Cincinnati alone being affected.

The price of raw materials continues firm. Plants are being worked at top notch capacity and many establishments have orders for several months ahead. There is a general feeling of optimism going the rounds and it is hard to find a pessimist among the trade.

Members of the industry feel that the greatest part of the reconstruction period has been traveled and that in the very near future business conditions in general will take on a much steadier aspect and that the business the country over will continue on its flourishing journey.

The Lunkenheimer Company, manufacturers of brass goods, have decided to go ahead with their new building projects, which call for a series of new buildings on a 150-acre plot in

Carthage, a Cincinnati suburb in the northern part of Hamilton County. It is planned to spend more than $1,000,000 on the new establishment, plans for which include various forms of recreation buildings and athletic fields for workmen. David C. Jones, first vice-president of the company, said that it has not been decided whether the company will build four or six buildings.

The Trojan Brass Manufacturing Company, of Cincinnati, has been incorporated with a capital of $50,000. The incorporators are J. Leuebbe, L. Leuebbe, R. Leuebbe, A. Schreck and W. B. Hillebrand.—H. C. L.

COLUMBUS, OHIO

MAY 10, 1920.

The metal market in Columbus and central Ohio territory is showing some weakness over conditions a month ago. This weakness had been noted during the previous month, but has increased more recently until practically all metals, excepting type metals and babbitt, are selling off from former levels. Metal-using concerns are not buying as actively, especially for future delivery, and there is some hesitancy as to present orders. On the whole the volume of business is considerably reduced by the switchmen's strike and the attending embargoes on the railroad. Large users have fairly good surplus stocks and they are apparently not worrying to any extent.

Copper is in fair demand with lake selling in the neighborhood of 18¾ to 19 cents per pound. Brass is only in fair demand with quotations at 19¼ to 19¾ cents for ingot. Brass scraps are selling at 16¾ to 17 cents per pound. There is a fair demand for aluminum around 30 cents for new stock. The demand for lead and tin is not as active as earlier in the year and the same is true of spelter and zinc.

On the other hand typemetals and babbitt are extremely strong and most of the jobbers are away back on orders. The printing business continues quite active and that is reflected on those two metals.

Owing to lack of fuel as a result of the switchmen's strike the plant of the American Stamping and Enameling Company, at Bellaire, Ohio, has been compelled to close down.

Nonnemacher & Frank have been awarded a contract for a large factory building for the Atlas Brass Foundry Company at 980 South Park street, Columbus.

The M. M. Strong Metal Products Company, of Cleveland, has been chartered with a capital of $210,000 by H. M. Strong, M. Stringer, J. R. Robinson, F. M. Lavelle and G. T. Bauder.

The Security Metal Products Company, of Cincinnati, has been chartered with a capital of $100,000 by W. P. Anderson, Victor L. Moeser, Guy W. Mallon, S. C. Donahue and H. W. Howard.

Owing to the interruption of train service as a result of the strike, the Ohio Metals Company, of Columbus, made arrangements to send urgent shipments by truck to Cincinnati and thence to Memphis.

The Victory White Metal Company, of Cleveland, has been chartered with a capital of $50,000 by Albert H. Frey, Marcus A. Whitehead, Isaac S. Mayfield, Andrew C. Larson and Harriet Whitehead.

The authorized capital of the Ideal Bronze Company, of Cleveland, has been increased from $30,000 to $100,000.

The General Bronze Foundry Company, of Cleveland, has been incorporated with a capital of $52,500 by R. H. Jamison, W. R. Daley, F. X. Cull, J. G. Bachman and J. H. Kellogg.—J. W. L.

CLEVELAND, OHIO

MAY 10, 1920.

Activities in the metal industry and its allied lines have been curtailed to a minimum by the strike of railroad employees in yards in the Cleveland district. Although the backbone of the strike was broken by the end of two weeks from the time it started, through Nickel Plate Railroad employees and others returning to work, there is a tremendous jam of freight at all terminals here. As this condition is typical of that in other sections outside the immediate Cleveland district, a tieup in industry has resulted. The situation is by no means as alarming as one would expect it to be, for the reason that it is but an exaggeration of a condition that has been prevalent for the last year or more.

Again, most plants in this district can find ready outlet for their products, though the principal channel of consumption, the automobile trade, has been slowed down for lack of materials and fuel. Shipments showed a gain of 25 per cent. to more distant points prior to the enactment of the walkout of yard and switchmen in railroad yards.

The labor situation here as a whole is no better than it has been for the last six months or a year. The increases in wages, bonuses and the like have been tremendous. This factor, combined with increased cost of fuel, raw material and general overhead, has brought an average increase of 30 per cent. in metal industry products over the prices at the beginning of the year.

At least one large firm here has apparently solved the labor problem, however, as indicated in the issue of new 8 per cent. preferred stock by the Lakewood Engineering Company, which is offering the stock to employees on partial payment plan. About 400 employees are taking advantage of the offer. The move is considered by both officials of the company and employees alike as another step toward fraternalism, not paternalism. It is part of the general policy established when the company was organized more than 20 years ago. As a result of these moves, the company's business is twice the size of its war business, though some sensational contracts, for size and shortness of time in completing them, were booked by this company. For instance, it supplied 90 per cent. of the narrow gage military track used by the army in France. At the close of the war six miles of track a day were being produced. Charles F. Lang is president of the company.

Another radical step in co-operating with employees is revealed in the announcement of William Frankham, owner of the Frankham Brass and Bronze Works Company, at Canton, to turn over the management of his plant to his two senior employees. The benefactors are Charles Becker, in the employ of the firm for 20 years, and for the last ten years manager of the furnace, and George Seiber, for ten years a mixer of metals. With two others they plan to incorporate for $50,000, add machinery and equipment and carry on the business on a larger scale. The Frankham business is nearly thirty years old, and three times the size it was when the first material was turned out. Mr. Frankham retains only an interest in the buildings and land. The business itself will be under the management of his former employees.

New plating establishment for Cleveland soon will be under way, following the plan of the T. F. Walsh Phonograph Supply Company, to install a complete department for this work in connection with the manufacture of talking machine accessories. The plant will be used for finishing these parts in gold, silver and oxidizing. The plant will be established on the third floor of the Ellastone Building, this city.

Many firms related to and depending upon the metal industry are going ahead with expansion plans. The Ohio Motor Vehicle Company is planning an entirely new addition to its plant at Nottingham Road, East Cleveland. The International Metal Hose Company shortly will start manufacture of its product here. It is said to be the only producer of flexible metal tubing in this section of the country. Clevelanders interested in the project are W. H. Miller, secretary and general manager, and Walter Phillip, chief engineer. The Buckeye Brass and Manufacturing Company, which recently purchased the plant of the Pneumatic Tool Company here, has started an addition to its plant, including a foundry and furnace building. The company proposes to increase its production of automobile specialties, including bushings and pumps. Plans for immediate rebuilding are being considered by the Central Brass Manufacturing Company, whose plant was damaged by fire to the extent of about $100,000. Considerable stock and equipment was damaged.

Organization of sixteen metal trades by American Federation of Labor officials has been started in this district.—C. C. C.

TRENTON, N. J.

MAY 10, 1920.

The daylight saving law inaugurated in Trenton on May 5 is very pleasing to the many employes of the Trenton metal plants. When the national government refused to adopt the daylight law various cities took up the question and the Trenton City Commission finally decided to please the majority of the

people by adopting it. This will give the metal workers daylight throughout their working day and also plenty of daylight when their day's labor is done. The daylight plan meets with the hearty approval of Trentonians.

The proposition to operate the Delaware and Raritan canal on Sundays besides weekdays will be of great benefit to the Trenton manufacturers. The canal, which runs between Bordentown and New Brunswick, connects the Delaware river with the Raritan and furnishes a reliable transportation route for the shipment of goods to the larger cities by water. The stream will be kept open continuously day and night and will greatly aid in the transportation of goods now that traffic is uncertain on the steam railroads. The railroads have become so congested of late that manufacturers have difficulty in having goods shipped. The recent railroad strike had a serious effect upon the Trenton manufacturers in not only shipping products, but in receiving raw material. The warehouses became so congested that it became necessary to use other buildings for that purpose. Some of the factories were compelled to use the parcel post system to ship goods. One Trenton concern spent more than $400 in a single day for parcel post shipments. The warehouses are now beginning to be cleared out of supplies.

The New Jersey Legislature has passed a measure providing for Americanization classes in day as well as in night schools, and extending financial aid for the work. Manufacturers have found that the Americanization of foreign employes has been of great benefit to them.

The polishers, buffers and grinders employed at the J. L. Mott plant who went on strike for a shorter working hour have been discharged by the firm and paid off in full. The company began breaking in new hands to take their places, but did not meet with much success. It was said that if these departments were closed very long the other departments of the big plant would have been affected and would undoubtedly have had to close down. With these departments practically closed, the work in the other departments is piling up.

The polishers, buffers and grinders, numbering about seventy-five and including both piecework and day hands, have been working 54 hours a week. They notified the company that they wanted a 48-hour week. This was refused by the concern and the pieceworkers quit their positions. They later returned to the plant and were joined by the day workers. The company then decided to discharge the strikers and seek new hands in their places. The foundry workers employed at the Mott plant went on strike some time ago for an increase in wages and this was granted after a short strike. Later in the month the differences between the polishers, buffers and grinders was adjusted and the men reinstated to their old positions with a shorter working day. There were no labor disturbances at the other metal plants during the month.

The Ajax Electrothermic Corporation, of Camden, N. J., was incorporated to manufacture and deal in electric heating apparatus, etc., by E. F. Northrup, H. D. Porter and Dudley Willcox, all of Trenton, N. J. The new company has 2,000 shares of stock divided into 1,000 shares of preferred and 1,000 shares of no nominal or par value.

The Trenton metal plants contributed several thousand dollars towards the fund for the Trenton Welfare Association. The John A. Roebling's Sons Company headed the list with $4,000, while the other plants contributing were Jordan L. Mott Company, Trenton Brass & Machine Company, McFarland Foundry & Machine Company and the Trenton Smelting & Refining Company.

The British-American Chemical Company, of Ridgefield Park, N. J., was recently fined $1,000 by Judge John B. Zabriskie in Hackensack, N. J. Offensive odors coming from the factory were responsible for the concern being indicted, brought to court and fined. The company pleaded non vult to the charge and counsel for the concern said that possibly the company was in a measure responsible for offensive odors emanating from the works, for which it had been indicted, but pointed out the difficulty of making necessary improvements under present labor conditions. This is the heaviest fine yet imposed upon a concern under the offensive law, and it is probable that other companies will also be indicted if the so-called nuisance is not abated in other parts of the state. The chemical and smelting concerns are the worst offenders, but no complaint has yet been made against a brass foundry.—C. A. L.

LOUISVILLE, KY.

MAY 10, 1920.

Business with the Louisville copper and brass working shops has been fairly active during the past month; there is a very fair demand for castings of various kinds, and sheet metal work is in better demand. The building movement is in full swing, and for the first three months of the year building operations were greater than during the whole of 1918, and far larger than during the first six months of 1919. The building movement is creating some demand for metal goods, especially in connection with heavy building of garages, industrial enlargements, etc.

Announcement has just been made of plans of the Monarch Brass Works, capitalized at $20,000 by John B. Engle, Jr., Charles F. Grainger, and C. S. Potter. The company will install a brass and metal working shop. Mr. Grainger is head of Grainger & Co., manufacturers of pumps, metal goods, machinery, etc. Mr. Grainger is also former Mayor of Louisville, manager of the Louisville Jockey Club's Churchill Downs Race Track, and a member of the newly appointed State Board of Athletic Control, which will look after boxing under the new State boxing laws.

R. V. Board, president of the Kentucky Wagon Manufacturing Company, in an interview with the correspondent of THE METAL INDUSTRY, stated that he had purchased six acres of additional land, and has a deal on for eight more, and planned new foundries, machine shops and other departments for production of automobiles and trucks on a larger scale.

B. F. Avery & Sons, manufacturers of implements, plows, etc., have increased the capital by two million dollars, and will enlarge the foundries, machine shops and general manufacturing departments.

The Red Chief Manufacturing Company, manufacturers of corn mills, has incorporated with a capital of $50,000, by A. T. Farnsley and others, and plans enlargement of the plant.

The United States Tin Foil Company has started work on a $90,000 addition to the Louisville plant, which will be equipped for a tin foil rolling mill.

Announcement has been made of the incorporation by Louisville men of the American Motorcycle Manufacturing Company, which has purchased the plant and machinery of a Columbus, O., manufacturer, and will set up a new plant at Eighteenth and Walnut streets, Louisville, to manufacture motorcycles in quantities, to sell at a more reasonable price than that asked for machines now on the market.

The Kentucky Association of Master Plumbers held its annual meeting in Louisville on April 19 to 21, having seventy-eight members present, and about three hundred people in all. The crowd was entertained at the plants of the Columbia Sanitary Manufacturing Company, Standard Sanitary Manufacturing Company, Laib Company, and P. A. Vogel & Sons, these including manufacturers and jobbers of plumbing goods.

Business with the Independent Brass Works is humming along at a fine gait, according to J. W. Rademaker, who reports that the casting demand is the best he has ever known.

Balke & Company, operating a foundry and iron works at Louisville, have filed amended articles increasing the capital from $25,000 to $50,000.

Amended articles have been filed by the O. K. Stove & Range Company, Louisville, increasing the capital to $300,000. The company produces stoves and ranges.

The Continental Auto Parts Company, Columbus, Ind., recently had a strike that carried out about one-half of its force, a union having been formed in the disguise of a lodge.

The Ashland Foundry & Machine Shops, Ashland, Ky., recently suffered a $30,000 fire loss, after being struck by lightning.

The Sheet Metal Workers' Union of Louisville have won the closed shop, along with an increase which carries the price up to eighty cents per hour. Announcement of this was recently made by P. H. Reardon, business agent.

MONTREAL, CANADA

MAY 10, 1920.

The metal working shops of Montreal continue very busy with the large volume of business booked the first three months of this year. Work is plentiful, but the labor problem will be felt considerably during May, as navigation here will be opened up between the 1st and 15th of May, which will interfere consider-

ably with the unskilled help which is employed in the foundries. Large numbers will migrate to the lakes and the wharves.

The Simmons Bedstead Company, of Kenosha, Wis., have now secured the controlling interest in the Alaska Bedstead Company of Montreal and have started new and modern additions to the plant, located at St. Ambrose and Deconcelles streets, by the building of a new two-story brick addition facing the Lachine Canal.

The new addition costing $50,000 of a machine shop 80 x 200 facing the Grang Trunk Railroad main line and one of the largest expansions planned this winter by the Jenkins Bros. Company, Ltd., is nearing completion.

The Eastern Brass Foundry Company has been incorporated for $49,000 to open and operate one or several foundries for brass, gold, silver, copper, aluminum, bronze and other metals. The incorporators are Francois Boulaine and Frank Lapham.

The Crane Company, Ltd., are now fully established in their new Canadian plant, and shipments are going to all their branch houses direct from Montreal.

Unless the money situation becomes permanently unsettled or labor becomes dissatisfied, which does not threaten at the present time, this will eclipse any of the past years for business in this district. Owing to the tieup of the railroads in the States the latter part of this month, the supply of copper in this market has been affected.—P. W. B.

BIRMINGHAM, ENGLAND

MAY 3, 1920.

In view of the ever increasing competition of iron and steel in certain departments of industry, British metallurgists are directing more attention than formerly to special alloys with a view to extending the scope of non-ferrous metal industries. Useful and stimulating contributions to such research are being made under the direction of Dr. Walter Rosenhain, F.R.S., at the National Physical Laboratory at Teddington. Some of this work was referred to in a lecture given by Dr. Rosenhain on "Some Special Alloys" on March 23rd, to the Birmingham Local Section of the Institute of Metals. He said that his object was not to place before the Section a large amount of detailed information concerning out-of-the-way alloys, as to endeavor to arouse interest in a subject which had never received sufficient attention from non-ferrous metallurgists in this country. The "special" alloys he referred to were those having unusual properties which enabled them to fulfill unusual purposes. He did not intend to deal with alloys which were described as "special" merely because of a claim to special strength. He illustrated his remarks by detailed reference to three or four types of special alloys used for particular purposes. His first example was an alloy used in the construction of electrical instruments because its electrical resistance remained constant independently of changes of temperature, differing enormously in that respect from most metals. Before the war, the whole world's supply of this material, known as "Manganin" came from a single works in Germany, and British attempts to imitate it had not been entirely successful. He then referred to an American alloy known as "Nichrome" which is now finding world-wide use as the material of electrical resistance heaters such as are used in laboratory furnaces and in domestic electric radiators. Here again reproductions based on chemical composition had not been proved entirely successful. But even "Nichrome" itself was in considerable need of further improvement. An alloy had recently been introduced in this country which resembled Nichrome, but was improved by the addition of a small amount of aluminum. This material withstood a bright red-heat for prolonged periods, but unfortunately it was not obtainable in the form of wire. Finally, the lecturer referred to alloys like "Stellite" which, although containing very little iron, were capable of serving as high-speed cutting tools and of giving service in some respects markedly superior to the best high-speed steels. Alloys for other special purposes, such as resistance to acids, or as a substitute for platinum for particular uses were then referred to. In conclusion, Dr. Rosenhain emphasized the necessity for the British industry to stand on its own feet in these matters and go forward by its own initiative.

Manufacturers in the brass and other metal trades who cater for home requirements are experiencing a lack of home orders. This is attributed to the check upon buying caused by the continuous increases in selling prices. Merchants in view of this tendency are not pressing for delivery as they were at the end of last year. The result is that some firms which two or three months ago were refusing forward commitments are now soliciting orders for gas, water and electrical fittings. Makers of aluminum hollow-ware are also showing themselves anxious for new business. The solicitude for orders is not attributed, however, wholly to failing demand, and it is not accompanied by any disposition to reduce prices. It is no doubt due in a great measure to the fact that most firms have completed the work of reconstruction after the war. Foreign business has been greatly stimulated by the recent British Industries Fair and this enables manufacturers to maintain a firm attitude with regard to prices. In view of the general upward tendency of all materials and the dearness and scarcity of fuel even further soaring in prices is generally expected.

VERIFIED NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Waclark Wire Company, Elizabeth, N. J., has changed its firm name to the American Copper Products Corporation.

The International Nickel Company, Constable Hook, Bayonne, N. J., has built a fuel oil storage plant, which is practically completed and in operation.

The Crown Rheostat and Supply Company have increased their capital from $35,000 to $75,000, which they found necessary on account of the increase of business.

The Pioneer Metal Goods Corporation, 317 West 125th Street, New York City, manufacture a patented die-cast tracker bar. They also take other orders for die-casting.

Shore Instrument and Manufacturing Company, Inc., formerly 555 W. 22nd Street, New York City, removed on April 15th to Van Wyck Avenue and Carll Street, Jamaica, N. Y.

The Dixie Brass and Foundry Company, Birmingham, Ala., has increased its capital stock from $15,000 to $100,000. They operate a brass, bronze and aluminum foundry, and grinding room.

The Cleveland office of the **Chase Metal Works** and **Chase Rolling Mill Company**, Waterbury, Conn., is now located at 310 Engineers Building, and is conducted by W. B. Fairfield and C. K. Lenz.

The New Jersey Zinc Company announce the following appointments in their Sales Organization: Mr. Bushnell Bigelow, Assistant General Sales Manager; Mr. Walter I. Hess, Manager of Eastern Sales.

The Acme Galvanizing and Tinning Company is the new name adopted by the Acme Galvanizing and Sales Company Reynolds and Wilcox Streets, Milwaukee, Wis. They operate hot galvanizing and tinning departments.

The Eastman Manufacturing Company, Manitowoc, Wis., was incorporated recently to manufacture brass and bronze appliances, by H. L. Eastman and others, with a capital of $25,000. They operate a brass machine shop.

The Hilo Varnish Corporation, Brooklyn, N. Y., celebrated the completion of the $100,000 addition to their plant on Saturday, March 20, by a house-warming and beefsteak dinner.

The Merchant & Evans Company, 2019 Washington Ave., Philadelphia, Pa., announce the opening of a branch office at 926 Chamber of Commerce Building, Detroit, Mich., which will be under the management of Mr. R. Frank Smith.

The Pyrene Manufacturing Company, Inc., has installed the Parker Process in its works at 410 E. 32nd Street, New York City, and is ready to do job rust-proofing for the eastern trade. L. E. Eckleman has charge of this department.

The American Metallurgical Corporation, Franklin Trust Building, Philadelphia, Pa., has announced the receipt of contracts for the development of special alloys from the Branford Electric Company and the Brown Pyrometer Company.

The Pioneer Brass Works, Indianapolis, Indiana, has increased its capital stock from $70,000 to $100,000. They oper-

ate a brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room and polishing departments.

The new enamelware plant of the **Ohio Valley Enameling Company,** Huntingdon, W. Va., which is now in the course of construction will be operated under the name of the Sax Stamping Company. They operate spinning and stamping departments.

The Aluminum Goods Manufacturing Company, 15th and Franklin Streets, Manitowoc, Wis., had preliminary plans prepared for the construction of a two-story, 60x350 ft. rolling mill on Main St. Estimated cost $500,000, but the building was indefinitely postponed.

The Modern Brass Manufacturing Company, Schleisingerville, Wis., has been incorporated with a capital stock of $10,000 by Otto E. Zahn, Albert Gensmann and M. E. Gensmann to build a brass foundry and machine shop. They will operate a brass, bronze and aluminum foundry.

The U. S. Copper Products Corporation of Cleveland, Ohio, announce the opening of their New York office, 1123 Broadway, New York City, suite No. 400-410, for the sale of their product (seamless brass and copper tubes). This branch will be under the management of Mr. Herbert Gnad.

The Milwaukee Die Casting Company, 297 Fourth Street, Milwaukee, Wis., sustained a small fire loss which stopped production for about ten days, but they are now running full capacity. This company operates a brass, bronze and aluminum foundry, brass machine shop, tool room and casting shop.

The Burlington Brass Works, Burlington, Wis., is having plans prepared for the erection of a foundry and shop addition 92x 144 ft. C. R. McCanna is president of the company. They operate a brass and bronze foundry, brass machine shop, tool room, grinding room, plating and polishing departments.

The American La France Fire Engine Company, 195 Weston Ave., Toronto, Ont., Canada, has awarded the contract for the construction of a two-story 40x80 ft., factory on Weston Road, estimated cost, $30,000, for a fire apparatus paint shop and shipping and receiving floor. They operate a brass machine shop.

The Stanley Insulating Company, Great Barrington, Mass., manufacturers of all steel vacuum bottles, has adopted a group bonus plan to include all employees. Under the plan the more bottles produced the more the men will receive in wages. This company operates a tool room, grinding room, soldering, plating, polishing and lacquering departments.

The Alloy Foundry & Machine Corporation, New Rochelle, N. Y., has been incorporated by J. Greve, W. E. Wollheim, and A. C. Wakeling, with a capital of $50,000, to manufacture metal castings and machined products. They will operate a brass, bronze and aluminum foundry, brass machine shop, grinding room, and casting shop.

The Buckeye Iron & Brass Works, Inc., Dayton, Ohio, has acquired title to the four story building at Third and Wyandot Streets, and they expect to make some improvements. This concern operates a brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, casting shop, plating and polishing departments.

The Mitsubishi Company, 120 Broadway, New York City, are making preliminary estimates on their new plant in Japan for manufacturing electrical machinery. This company operates smelting and refining departments, brass, bronze and aluminum foundry, tool room, grinding room, casting shop, rolling mill, galvanizing, plating, polishing, japanning and lacquering departments.

The Brown Instrument Company, Philadelphia, Pa., has placed C. C. McDermott in charge of their Chicago office, succeeding J. W. Lazear, who recently resigned to take up other work in New York. Mr. McDermott has been transferred from the Philadelphia office where he has been district manager. This company operates a brass machine shop, tool room, grinding room, soldering, plating, polishing and lacquering departments.

The McKenna Brass & Manufacturing Company, 1st and Ross Streets, Pittsburgh, Pa., is having plans prepared for a four-story and basement addition, 64 x 84 ft., to cost $150,000. It will be equipped for the most part as a machine shop. This concern operates a brass, bronze and aluminum foundry, brass machine shop, tool room, plating, polishing and lacquering departments.

The Eastern Brass and Ingot Corporation, Waterbury, Conn., well known to the trade as the manufacturers of Briquet-Ingots, have added foundry and laboratory equipment to produce brass ingots to specifications and to convert clients' material into ingots of uniform quality on a conversion charge per pound basis. They operate a smelting and refining, brass and bronze foundry, and a casting shop.

The Metals Refining Company, Incorporated, manufacturers of White Metal Alloys, with offices at 806 Edison Building, Chicago, and plant at Osborn, Ind., advise that they will buy within the next twelve months approximately 15,000 tons of Lead Battery Plates, on an average of 50 tons per day. They state that they are always buyers of this commodity and can offer shippers a good steady market.

Chas. T. Tarpenning and **B. E. LaFollette** have organized under the name of the **Tarpenning-LaFollette Company** and have taken over the business formerly conducted under the name of Chas. T. Tarpenning at 301-305 Virginia Avenue, Indianapolis, Indiana. They will specialize in the design and installation of fan and blower systems for ventilating, heating, cooling or drying; for the removal and collection of dust or shavings; and for the supplying of air for all industrial purposes.

Etowah Foundry & Machine Company, Gadsden, Ala., which was recently organized by W. T. Murphree, Evan J. Owen and C. P. Butcher, has purchased a fully equipped foundry and is prepared to manufacture iron, brass and copper castings. The company is planning to build and equip a modern machine shop, and equipment for this extension as well as some additional foundry equipment will be needed. They operate a brass, bronze and aluminum foundry and casting shop.

The Alemite Die Casting & Manufacturing Company, Chicago, has purchased a site on which it will build a plant containing about 100,000 square feet of floor space. The products of the concern will consist of die molded castings and automobile accessories. John S. Gullberg is president of the company. They will operate a smelting and refining department, brass, bronze, an aluminum foundry, brass machine shop, tool room, casting shop, stamping, plating and polishing and lacquering departments.

The McAdamite Aluminum Company has been merged with and will hereafter be controlled and operated by the General Aluminum & Brass Manufacturing Company, of Detroit. Extensions are now under way and a program for largely increased facilities and manufacture is being undertaken. The McAdamite plant will be run as a separate unit, devoted exclusively to aluminum products, but all accounting, reports, inquiries and correspondence will be done direct with the General Aluminum and Brass Manufacturing Company, E. Grand boulevard and St. Aubin ave., Detroit, Mich.

The International Metal Works, of Brockville, Ont., Canada, employing about fifty hands, has announced a profit-sharing scheme according to the following plan: At the end of the year 10 per cent. of the profits is set aside for depreciation; a maximum of 10 per cent. is then paid on the capital invested, and twenty-five per cent. is set aside as a rest account to provide for losses or unforeseen expenses. The balance is divided on a fifty-fifty basis between capital and labor. This applies to those who have been in the employ of the company for one year or more. Payments to employees are made in twelve or twenty-four installments, according to the method of payment, and they are divided pro rata, according to the earnings of each employee. At the end of five years, if there have been no losses a further distribution is to be made for the rest account, on a fifty-fifty basis, between capital and the employees who have been in the service of the company for three years or more. This company operates stamping, soldering and japanning departments.

MARKET FOR METALS IN ARGENTINA

There appears to be a considerable market in Argentina for brass and copper in certain forms, and how much of the demand can be supplied from the United States depends upon price, qual-

ity, packing and strict compliance with the conditions of orders received. The materials of brass and copper in the electrical, plumbing, automobile, and novelty trades are chiefly the following:

Brass sheets, in thicknesses of 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1, 1.1, 1.2, 1.5, 1.8 and 2 millimeters. The greater demand for these is in size 1 by 2 meters, but they are also desired 0.9 by 1.8 meters. Sheets must be good for lathe and turning work.

Smooth, round brass tubes in diameters of one-fourth and five-sixteenths inches, each 0.8 millimeter thick; three-eighths, seven-sixteenths, one-half, nine-sixteenths, five-eighths, three-fourths and seven-eighths inches, each 1 millimeter thick, and 1, 1¼, 1½, 1¾ and 2 inches, each 1.1 millimeters thick.

Brass plates 4 to 5 meters long and one-eighth inch thick, in widths of one-fourth, five-sixteenths, three-eighths, seven-sixteenths, one-half, five-eighths, three-fourths, seven-eighths of an inch, and 1 inch.

Copper sheets 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, and 1 millimeter thick.

Copper wire in rolls, in diameters of 1, 1½, 2, 2½, 3, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 12, 15, 18, 20, 22 and 25 millimeters. Sizes up to 5 millimeters are most used. Brass tubes, small rods and round hexagonal bars are also imported.—Consul General William Henry Robertson, Buenos Aires, in the Commerce Reports.

STOCK INCREASES PENDING

A special meeting of stockholders of the **William Cramp & Sons' Ship & Engine Building Company,** has been called for July 1 to vote on increasing the capital stock by $15,000,000. If favorable action is taken, a stock dividend of 150 per cent, or $9,147,000, will be declared by directors. The remainder of the increase will be retained for capital purposes.

Stockholders of the **New Jersey Zinc Company** met May 12 to vote on the proposal to increase the capital stock from $35,000,000 to $50,000,000. Of the $15,000,000 new stock, half will be paid to shareholders in the form of a stock dividend. This would be at the rate of 20 per cent. on present holdings. It was also proposed to extend the right to stockholders to subscribe to the additional $7,000,000 in new stock at par, $100 a share.

The remaining $1,000,000 new stock will be offered to employes at a price and upon terms not as yet decided. The books close for the meeting on April 30.

BUSINESS TROUBLES

United Smelting and Refining Works, Inc. A petition in bankruptcy has been filed against the United Smelting and Refining Works, Inc., at 259 Front street, New York City, by their creditors: Isaac Gerson, $1,200; Bassman & Koones, $2,150, and Solomon Shapiro, $800. An assignment was also made to Archibald Palmer. The company was incorporated in 1919 with a capital stock of $50,000. Morris Sack, who is president, and David Bienstock have filed a petition in bankruptcy as partners under the firm name of United Smelting and Refining Works, at 259 Front street, with liabilities of $35,874 and assets given as unknown, among which are seventy-five shares of United Smelting and Refining Works, Inc., held by each of the petitioners. Among the creditors are Market & Fulton Bank, $9,000; S. Reubens & Brother, $6,050, and Metropolitan Bank, $4,000. Various other claims, described as damages by reason of breach of contract, are given as amounts unknown.

A petition in bankruptcy has been filed against the American Bronze Corporation of 1378 Cromwell Ave. and 208 East Twenty-seventh Street, New York City, by these creditors: Hart Trading Co., Inc., $7,573; A. G. Butler, Inc., $92, and the John Kust Co., $107. Liabilities are stated to be $20,000 and assets $10,000. A circular sent to creditors says that the difficulty is primarily due to inability to market the preferred stock of the company, by which it was expected to obtain working capital, and the only asset remaining is a $16,000 equity in the real estate at 1376 Cromwell Avenue; but the company is not in a position to make the equity available. The company was incorporated March 31, 1919, with capital stock of $3,000,000.—New York Times, April 17, 1920.

MARINE EXHIBITION

At the Marine show held recently in New York City there were a number of exhibitors whose products were of interest to the metal industries. Brass, bronze and zinc (in the form of galvanized iron) were plentifully displayed. Among the exhibitors were:

The Chadburn (Ship) Telegraph Company of America, Inc., Troy, N. Y.—Ship telegraphs, engine counters, horoturbometers, speed indicators, binnacles and other marine specialties.

Wilson Welder and Metals Company, Inc., New York City, complete "Plastic Arc" units, for welding cast iron, steel, copper, brass and aluminum.

American Manganese Bronze Company, Holmesburg, Pa.—Manganese bronze gears and propellers.

Hyde Windlass Company, Bath, Me.—Manganese bronze propellers.

Thomas Gregory Galvanizing Works, Brooklyn, N. Y.—Zinc coating for iron and steel objects of all shapes and sizes.

Columbian Bronze Corporation, New York City.—Manganese bronze propellers.

International Nickel Company, New York City.—Monel Metal specialties for marine purposes, such as turbine blading, etc.

BROOKLYN INDUSTRIAL EXHIBIT

The annual Brooklyn Industrial Exhibition, the third event of its kind, was held at the 23rd Regiment Armory, in that city, during the week of April 10-17. Occupying practically the entire drill floor of this large building were over 300 booths representing 180 exhibitors; firms representing many industries and lines of manufacture, including many very large concerns. It was of particular significance to the metal trades, however, through the large part played by the representatives of these industries in the inception and accomplishment of this exhibit, and among whom were some of the most widely known concerns in the country. That this was evident at the exhibition is shown by the names of the exhibitors and the products which they presented, a partial list of which is shown below.

The E. W. Bliss Company occupied a large space with several metal stamping machines and an interesting collection of photographs showing the many applications of their machines.

The Doehler Die Casting Company's exhibit of die castings was very large and showed a great variety.

The John Polacheck Bronze & Iron Company showed an artistically arranged exhibit of fine architectural and statuary bronze, including a number of tablets.

Thomas Paulson & Son displayed their "Hecla" anti-friction bronzes and babbitt metals.

Alfred Nelson Metal Works, builders of copper jacket kettles and other vessels, had several of these on view.

The Brooklyn Fire Brick Works displayed the various refractory materials which they manufacture.

R. Hamilton & Sons exhibited ingots and castings of non-ferrous metals and alloys.

Joseph G. Kessler exhibited metal scrap and the finished ingots which he turns out from it.

The J. W. Richardson Foundry Corporation showed a fine lot of castings of aluminum brass and bronze, etc.

The Improved Appliance Company had in operation at their booth several of their latest gas appliances for metal melting.

The Maxon Premix Burner Company, of Muncie, Ind., had a furnace in operation in connection with their burner.

Monday evening, April 12, was featured as Metal Trades Exchange night, and a special program was arranged by the Brooklyn Metal Industries Exchange. A meeting was held at which addresses were made by H. H. Doehler (of the Doehler Die Casting Company, who is also vice-president of the Brooklyn Chamber of Commerce), its president, and James Skinner, of the E. W. Bliss Company, its vice-president. This constituted the official opening of the exhibition and was followed by motion pictures illustrating the industries of Brooklyn.

TRADE PUBLICATIONS

Sand Blast and Allied Equipment, a condensed catalogue in Italian, issued by the Pangborn Corporation, Hagerstown, Md.

Aluminum and White Metals—a booklet, issued by the United Smelting and Aluminum Company, New Haven, Conn.,

which has special reference to aluminum sheets, ingots, alloys and babbitt metals.

An Aid to Americanization in Industry—a pamphlet issued by the Elliott Service Company, 141 West 36th street, New York City, on the necessity for Americanizing the immigrant, who plays such a large part in our industrial life.

Aluminum Mouldings, a booklet on extended aluminum sections, many thousands of feet of which are used in the automobile trade. The booklet can be obtained from the British Aluminum Company, Ltd., 165 Broadway, New York City.

Electrical Apparatus for Metallurgical and Chemical Industries—a most instructive and completely illustrated descriptive booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. A valuable addition to the files of every engineer, chemist or manufacturer.

Seven Centuries of Brass Making—a book, issued in magazine form by the Birdgeport Brass Company, Bridgeport, Conn., which gives a "brief history of the ancient art of brass making and its early (and even recent) method of production, contrasted with that of the electric furnace process." It is probably one of the best general reviews of the brass industry published. Its pictures of early brass making plants, and the unusually good interiors of modern plants, make it a very interesting and useful publication.

Laboratory Experiments with Thermit Process of Welding, —the third and revised edition of a pamphlet by that title issued by The Metal & Thermit Corporation, of New York City. This pamphlet is useful as a guide for acquainting students with the substance, characteristics and results of the Thermit Reaction. The pamphlet illustrates and describes various experiments which are intended to show the speed of the reaction, the heat produced thereby and the effects obtained by the superheated liquid slag and the superheated liquid steel.

Diagonal Deck Concentrating Tables—a catalogue issued by the Deister Concentrated Company, Fort Wayne, Ind., illustrating and describing the Deister Overstrom type of table. It includes the new Running-in-Oil-Head motion on both the Deister and Overstrom types.

Huther Brothers' Dado Head—a folder by the P. Pryibil Machine Company, 512 West 41st street, New York City, on the Dado Head saw for cutting grooves.

Standard Rubber Insulated Wire—an attractive catalogue issued by the Standard Underground Cable Company, Pittsburgh, Pa., giving sizes, gauge numbers, thickness of rubber, weights for various kinds of wire.

Spotlight—the house organ of the Waterbury Farrel Foundry & Machine Company, Waterbury, Conn. A young publication, but bright and cheerful in appearance and content.

Power Field Saws—a catalogue issued by the Gifford-Wood Company which includes many testimonials.

METAL STOCK MARKET QUOTATIONS

	Par.	Bid.	Asked.
Aluminum Company of America	$100	$525	$550-650
American Brass	100	220	210-220
American Hardware Corp.	100	157	139-143
Bristol Brass	25	34	26-29
International Silver, com.	100	30	35
International Silver, pfd.	100	92	97-100
New Jersey Zinc	100	240	275-285
Rome Brass & Copper	100	280	290-330
Scovill Mfg. Co.	100	400	400-420
Yale & Towne Mfg. Co.		250	275-285

Corrected by J. K. Rice, Jr., & Co., 26 Wall Street, New York.

METAL MARKET REVIEW

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE

COPPER

Insurgent labor demands in April resulted in a demoralization of conditions in the business situation which resulted in loss to all concerned. Traffic congestion made railroad embargoes necessary and all business was impeded. Strikes at brass founders' and other metal-working plants in New England caused a reduction in melting, curtailing the need for copper. Other plants suffered from a shortage of fuel, while not a few plants were obliged to shut down. Estimates of sales or shipments of copper during the month were difficult to make, the trade believing that producers' orders were probably not more than 100,000,000 pounds, including export sales. Shipments into domestic consumption did not exceed current sales. Producers, who had advanced prices early in the month to 19c. delivered for electrolytic covering second quarter, asked 19.25c. for July-August. In the open market the dullness existing throughout the month brought about a decline in prices. Late in the month, with conditions improved, some business in electrolytic was done at 19.50c. f. o. b. refinery for fourth quarter shipment. Nearby shipments, under less pressure to sell, declined ¼ to ½c.; second hands making sales at 18.50c. f. o. b. refinery for prompt and May shipment. A feature of the month was found in the Government statistics which revealed March exports, approximating 85,000,000 pounds, the largest monthly outgo since January, 1918. Prices on April 30, also on May 7, for prompt and May, were 19c. for prime Lake, 18.50c. for electrolytic and 18.37½c. for casting.

TIN

The volume of transactions in the tin market during April was less than in many months, the tendency of prices on all kinds of tin being downward. There was a net decline of 2.50c. on spot Straits from 63.50c. at the beginning to 60.75c. on the last day. Fluctuations in prices, however, carried to as high as 63.50c. on April 8, and the lowest prices were paid on the last day. Since May 1 the price has dropped to 56¼c. American pure tin, after selling early in the month at same level of prices as Straits metal, was later in the month held at a fraction below Straits. Banca tin, available only between April 9 and 20, sold at 61.75c. to 62.25c. f. o. b. New York, while it lasted; 99 per cent. pure tin, throughout the month, was held at 1.00c. below Straits, following its changes closely. Deliveries into American consumption during April, were only 3,305 tons, of which 2,700 tons were shipped from Atlantic ports. Total deliveries were the smallest since October, 1919.

LEAD

Although prices of the leading interest, the American Smelting & Refining Company, remained unchanged at 9.00-9.25c. East St. Louis and New York, respectively, throughout the month, there was an easier tendency in the outside market. This tendency resulted in a net decline of 20 points per pound in asking prices, from 8.70c. East St. Louis, 9.00c. New York, for prompt May and June shipments, April 1, to 8.50-8.75c. East St. Louis, 8-75-9.00c. New York, bid and asked, for same shipments on May 1. These prices have since prevailed. While business in all metals was interrupted and restricted by labor revolts interfering with traffic and distribution of freight, the lead industry seemed to suffer less than others, that is, in the extent to which demand for metal was lessened. Demand for lead continued active throughout the month, although in lessened volume.

ZINC

A decline of five points in prices of zinc on April 1 carried to 8.60c. East St. Louis, 8.95c. New York, on all positions to third quarter inclusive. The downward tendency continued daily until April 11, when quotations were 8.35-8.45c. East St. Louis, 8.70-8.80c. New York. There having been an advance in London in the meantime, prices here, on April 12, recovered five points, maintaining the advance for three succeeding days, during which time some export transactions were made. By middle of the month labor strikes, which later resulted in freight congestion, necessitating railroad embargoes, brought business practically to a standstill, and prices gradually declined, again reaching the lowest figures of the month April 23, at 7.85-7.90c. East St. Louis, 8.20-8.25c. New York. With some improvement in conditions during the last week of the month, combined with a recovery in prices at London, prices here recovered to 8.00-8.10c. East St. Louis, 8.35-8.45c. New York, however, in the absence of demand, prices on the last day of the month receded, closing at 7.90-8.00c. East St. Louis, 8.25-8.35c. New York, only five points above the

lowest figures of the month and making the net decline 70 points, approximately ¾c. per pound. Since May 1 prices have receded to 7.80-7.90c. East St. Louis and 8.15-8.25c. New York.

ALUMINUM

The Aluminum Company of America made no change in its schedule of prices during April, virgin being held at 33c., No. 12 at 31.50c. and sheet 18ga. and heavier at 44.20c. per pound. In the outside market prices, after being firm throughout the first twenty days of the month, were advanced ½c. on April 20, to 31.50-32c. for virgin 98-99 per cent., to 31.00-31.50c. for 98-99 per cent. demelted, and to 29.50-30.50c. for No. 12 remelted. By that day spot supplies had been depleted and virgin aluminum afloat and on dock in the harbor was held at 32.00c. asked, with bids being made at 31.50c. The advance was firmly held over the remainder of the month.

ANTIMONY

Continued heavy arrivals of antimony further depressed the market in April. Prices declined a net of ½c. per pound from 10.50c. on April 1 to 10.00c. on April 30, duty paid, for prompt and May, wholesale metal; jobbing business being done at 10.25-10.50c., according to quantity purchased. On April 7, because of strength in the Orient market, which in the interval had worked upon the fears of some traders, prices here were advanced to 10.62½c., followed a week later by a further advance to 10.75c., duty paid, New York. By April 20 light demand and increasing supplies combined with a decided weakening in prices of offerings from the Orient and a decline began which caused a recession to 10.00c., duty paid. Since May 1 the spot price has receded to 9⅞c.

SILVER

Prices of bar silver fluctuated within a range of 15½c. per ounce in April, the highest price being $1.27 on April 6 and the lowest $1.11½ on April 30. The net decline, however, was ½c. less than the range since the price on April 1 was $1.26½ per ounce. The closing price was the lowest of record since September, 1919. The outlook was for a continued decline, as demand in the Far East has come to a standstill, and the London market is being flooded with the meltings of silver coinage from Central Europe, thrown upon the market because of the high prices recently prevailing and which made such meltings profitable. The financial collapse in Japan was also a factor in the decline. Since May 1 the price has dropped further to $1.05½ per ounce. Production in this country, last year, was only 55,285,196 ounces, the smallest since 1909; it was 67,810,139 ounces in 1918.

QUICKSILVER

Prices of quicksilver, after being advanced $8 to $103 per flask of 75 pounds on April 1, were unchanged thereafter, until April 26, when because of increased supplies there was a decline of $3.00 per flask to $100. A further decline in May brought the price down to $85.

PLATINUM

The price of platinum in April was unchanged at the March closing $142 per ounce for pure until April 6, when a decline to $133 occurred. By April 27 another decline was noted this time to $115 to $125 per ounce, making the decline for the month $17 per ounce. Because of increasing supplies the outlook was for a further decline in May.

OLD METALS

Unsettled conditions due to insurgent labor interfered with all business in April and brought about depression in the old metals trade. The result was a shading of prices in order to do business. Coppers were off to 14c. for light, to 16.50c. for strictly crucibled and to 16.25c. for uncrucibled wire. No. 1 composition scrap, after being held at 15.75c. was at the end of the month, when conditions had improved somewhat, back to 16c., while composition turnings had recovered ¼c. to 14c. per pound. Aluminum clippings after having held firm at 26.50c. declined on April 21 to 26c. New brass clippings also on that day were down to 11.50c. Other declines amounting to ¼c. per pound were heavy lead, to 7.25c., new zinc scrap to 6.25c., electrotype to 7.25c. and stereotype to 7.75c. per pound.

WATERBURY AVERAGE

Lake Copper. Average for 1919, 19.55. 1920—January, 19.25. February, 19.125.—March, 18.875.—April, 19.125.

Brass Mill Zinc. Average for 1919, 8. 1920—January, 9.75. February, 9.40.—March, 9.15.—April, 8.85.

APRIL MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
Copper:			
Lake	19.25	19.00	19.048
Electrolytic	19.00	18.37½	18.536
Casting	18.62½	18.25	18.399
Tin	63.50	60.75	62.202
Lead	9.25	8.75	9.00
Zinc (brass special)	8.75	8.00	8.419
Antimony	10.75	10.00	10.452
Aluminum	32.00	31.00	31.607
Quicksilver (per flask)	$103.00	$100.00	$102.286
Silver (cts. per oz.)	127	111.5	119.5

INQUIRIES AND OPPORTUNITIES

Inquiry 2566—Who makes machinery for extruding aluminum shapes. We are particularly interested in apparatus for aluminum rods approximately 18" long x ¼" diameter for welding purposes.

Inquiry 2569—We are in a position to place large annual contracts for metal with a melting point over 1,000 to 1,200 degrees F., which can be easily cast without showing air-holes, blow-holes or other impurities; can be polished and nickelplated or because of its white color, needs no nickelplating and needs buffing only. It is essential that the price be lower than the cost of copper plus nickelplating.

Inquiry 2571—Please give us the names of makers of a good coke oven for artificial gas fuel.

Inquiry 2572—We are in the market for 10,000 bolts or chair rods about ¼" diameter and 10" long with round, oval, flat or countersunk head, and wing nut, dull finish nickel plate. Cash with order.

Inquiry 2574—We are in the market for a small rolling mill for brass sheets.

Metal Prices, May 10, 1920

NEW METALS

	Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER.	
Manufactured 5 per centum.	
Electrolytic, carload lots	18½-19.00
Lake, carload lots	19.00
Casting, carload lots	18⅜
TIN—Duty Free.	
Straits or Australian, carload lots	56.50
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 20%. Pig lead, carload lots	8.75-9.25
ZINC—Duty 15%.	
Brass Special	8.15-8.25
Prime Western, carload lots	8.37½
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	....
100-lb. f. o. b. factory	....
Ton lots, f. o. b. factory	32-33
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	
NICKEL—Duty Ingot, 10%. Sheet, strip, strip and wire, 20% ad valorem.	
Ingot	43.00
Shot	43.00
ELECTROLYTIC	45.00
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 20% ad valorem (100 lb. lots)	$1.60-$1.85
BISMUTH—Duty free	$2.70-$3.00
CADMIUM—Duty free	Nominal $1.40
CHROMIUM METAL—Duty free	Nominal
COBALT—97% pure	$2.50-$3.00
QUICKSILVER—Duty 10% per flask of 75 pounds	$85.00
PLATINUM—Duty free, per ounce	$115-$125
SILVER—Government assay—Duty free, per ounce	1.05½
GOLD—Duty free, per ounce	$20.67

Metal Prices, May 10, 1920

INGOT METALS

Silicon Copper, 10%	according to quantity	49	to55
Silicon Copper, 20%	" " "	36	to40
Phosphor Copper, guaranteed 15%	" " "	26	to33
Phosphor Copper, guaranteed 10%	" " "	25	to32
Manganese Copper, 30%	" " "	65	to72
Phosphor Tin, guarantee 5%	" " "	75	to78
Phosphor, Tin, no guarantee	" " "	70	to75
Brass Ingot, Yellow	" " "	15	to16½
Brass Ingot, Red	" " "	20	to23
Bronze Ingot	" " "	20	to25
Parsons Manganese Bronze Ingots	" " "	22½	to24
Manganese Bronze Castings	" " "	32	to42
Manganese Bronze Ingots	" " "	19	to23
Manganese Bronze Forgings	" " "	30	to40
Phosphor Bronze	" " "	24	to30
Casting Aluminum Alloys	" " "	32	to34
Monel Metal	" " "	38	to..

OLD METALS

Buying Prices.		Selling Prices.
16½to17½	Heavy Cut Copper	18 to18½
16 to16½	Copper Wire	17½to18
14½to15	Light Copper	16½to17
16 to16½	Heavy Machine Comp.	17½to18
11½to12	Heavy Brass	12½to13
9 to 9½	Light Brass	10½to11
9 to 9½	No. 1 Yellow Brass Turnings	11 to11½
14 to14½	No. 1 Comp. Turnings	16 to16½
4.25	Heavy Lead	4.90
4.25	Zinc Scrap	5.00
10 to13	Scrap Aluminum Turnings	11 to14
21 to23	Scrap Aluminum, cast alloyed	23.50to25
24.00	Scrap Aluminum, sheet (new)	26.50
36.00	No. 1 Pewter	40.00
18.00	Old Nickel anodes	20.00
26 to28	Old Nickel	30 to32

BRASS MATERIAL—MILL SHIPMENTS

In effect January 7, 1920.

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.25¼	$0.27¼	$0.29
Wire	.25¼	.27¼	.29
Rod	.23¾	.28	.30
Brazed tubing	.37	..	.41¾
Open seam tubing	.37	..	.41¾
Angles and channels	.38	..	.42¾

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.26½	$0.28½	$0.30¼
Wire	.26½	.28½	.30¼
Rod	.25	.29¼	.31¼
Brazed tubing	.38¼	..	.43
Open seam tubing	.38¼	..	.43
Angles and channels	.39¼	..	.44

SEAMLESS TUBING

Brass, 30½c. to 32½c. per lb. base.
Copper, 32c. to 34c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	29½c.	net base
Muntz or Yellow Metal Sheating (14"x48")	25¾c.	" "
Muntz or Yellow Rectangular Sheets other than Sheathing	26¾c.	" "
Muntz or Yellow Metal Rod	23¾c.	" "

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	29½c.	net base
From stock	32½c.-35c.	net base

BARE COPPER WIRE—CARLOAD LOTS

22¾c. to 23¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order.....31½c. per lb. base
100 lbs. to 300 lbs. in one order.....32½c. " " "

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 12½c. basis, less 8 per cent.

Casks, jobbers' prices	14c.
Open casks, jobbers' prices	14½c.

ALUMINUM SHEET AND ROD

Sheet Aluminum, base price, 52c. per lb. Coils 48c. per lb.

ROD.

B. & S. Gauge.

¼" to 1" Advancing by 32nds
1" to 2⅝" " " 16ths } 98% rolled, 43.10 cents per lb.
2⅝" to 3½" " " 8ths

⅜" to ¾". 98% rolled and drawn.....48.80 cents per lb.

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c., over 25 to 50 lbs., 17c. over, less than 25 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 2c. over N. Y. tin price, 100 lbs. or more, 5c. over Pig Tin. 50 to 100 lbs., 12c. over, 25 to 50 lbs., 15c. over, less than 25 lbs., 25c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

MONEL METAL

Shot	35
Blocks	35
Sheet Bars	40
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	54
Hot Rolled Sheets (base)	55

Lead Foil—base price—figured on base price of lead at the time.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 1.07 to 1.10 per Troy ounce, depending upon quantity.

Rolled sterling silver, $1.02½ to $1.06.

NICKEL ANODES

85 to 87% purity	.55c.	per lb.
90 to 92% "	.57½c.	per lb.
95 to 97% "	.60c.	per lb.

Supply Prices, May 10, 1920

CHEMICALS

Acid—		
Boric (Boracic) Crystals	lb.	.25
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.05
Hydrochloric, C. P., 20 deg., Carboys	lb.	.10
Hydrofluoric, 30%	lb.	.40
Nitric, 36 deg. Carboys	100 lb.	7.28
Nitric, 42 deg., Carboys	100 lb.	7.90
Sulphuric, 66 deg., Carboys	lb.	.03½
Alcohol—		
Denatured	gal.	1.50
Alum—		
Lump, Barrels	lb.	.05½
Powdered, Barrels	lb.	07.
Aluminum sulphate, commercial tech	lb.	.15
Aluminum chloride solution	lb.	.16
Ammonium—		
Sulphate, tech., Barrels	lb.	.08½
Sulphocyanide	lb.	1.15
Argols, white, see Cream of Tartar	lb.	.80
Arsenic, white, Kegs	lb.	.18
Asphaltum	lb.	.35
Benzol, pure	gal.	.75
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.10½
Calcium Carbonate (Precipitated Chalk)	lb.	.15
Carbon Bisulphide, Drums	lb.	.09
Chrome Green	lb.	—
Cobalt Chloride	lb.	2.00
Copper—		
Acetate	lb.	.60
Carbonate, Barrels	lb.	.29
Cyanide	lb.	.65
Sulphate, Barrels	lb.	.09
Copperas (Iron Sulphate, bbl.)	lb.	.02½
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.80
Crocus	lb.	.15
Dextrin	lb.	.25
Emery Flour	lb.	.10
Flint, powdered	ton	—
Fluor-spar (Calcic fluoride)	ton	—
Fusel Oil	gal.	5.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	—
Shellac	lb.	—
Iron, Sulphate, see Copperas, bbl	lb.	.04
Lead Acetate (Sugar of Lead)	lb.	.25
Yellow Oxide (Litharge)	lb.	.25
Mercury Bichloride (Corrosive Sublimate)	lb.	1.92
Nickel—		
Carbonate Dry	lb.	.80
Chloride, 100 lb. lots	lb.	.65
Salts, single, bbl.	lb.	.17
Salts, double, bbl.	lb.	.15
Paraffin	lb.	.25
Phosphorus—Duty free, according to quality		40-45
Potash, Caustic, Electrolytic 88-92%, fused	lb.	.32
Electrolytic 70-75%, fused	lb.	.26
Potassium Bichromate, Casks	lb.	.43
Carbonate, 80-85%	lb.	.25
Cyanide, 98-99½%, 100 lb. cases	lb.	.24
Pumice, ground, bbls.	lb.	.05
Quartz, powdered	ton	—
Official	oz.	—
Rosin, bbls.	lb.	.08½
Rouge, nickel, 100 lb. lots	lb.	.40
Silver and Gold	lb.	.60
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.20
Sal Soda	lb.	—
Silver Chloride, dry	oz.	1.43
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.81½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—		
Biborate, see Borax, bbls	lb.	.10½
Bisulphite, tech.	lb.	.07
Cyanide, 96 to 98%, 100 lbs	lb.	.27
Hydrate (Caustic Soda)	lb.	.15
Hyposulphite, 100 lb. lots	lb.	.03¾
Nitrate, tech., bags	lb.	.06
Phosphate	lb.	.05
Silicate (Water Glass) bbl.	lb.	.03
Sulpho Cyanide	lb.	.90
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.25
Sulphur (Brimstone) bbls.	lb.	.03
Tin, Chloride	lb.	.65
Tripoli Composition	lb.	.02½
Verdigris, see Copper Acetate	lb.	.60
Water Glass, see Sodium Silicate, bbls	lb.	.03
Wax—		
Bees, white ref. bleached	lb.	—
Yellow	lb.	.60
Whiting	lb.	.05
Zinc., Carbonate, bbls.	lb.	.24
Chloride, 600 lb lots	lb.	.15
Cyanide	lb.	.45
Sulphate, 100 lb. cases	lb.	.05

COTTON BUFFS

Open buffs, per 100 sections (nominal).		
12 inch, 20 ply, 64/68, cloth	base,	$110.70
14 " 20 " 64/68, "	"	137.50
12 " 20 " 84/92, "	"	143.30
14 " 20 " 84/92,	"	193.05
Sewed buffs, per pound		
Bleached and unbleached	"	.90

FELT WHEELS

		Price Per Lb.
White Spanish—		
Diameter— 6" to over 16"	Thickness—½" and ¾"	$4.00
" 6" and 8"	" 1" to 3"	3.35
" 10" to 16"	" 1" to 3"	3.25
" over 16"	" 1" to 3"	3.35
" 6" to over 16"	" over 3"	3.40
Grey Mexican—		
Diameter— 6" to over 16"	Thickness—½" and ¾"	$3.90
" 6" and 8"	" 1" to 3"	3.25
" 10" to 16"	" 1" to 3"	3.15
" over 16"	" 1" to 3"	3.25
" 6" to over 16"	" over 3"	3.30

Above are even diameters, Odd diameters 50c advance.